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Dredge of the Dixie Sand and Gravel Co., Chattanooga, Tenn. The bucket has just been dropped and is being pulled back by the "backing" line

Changes and Improvements in Operation of Dixie Sand and Gravel Company

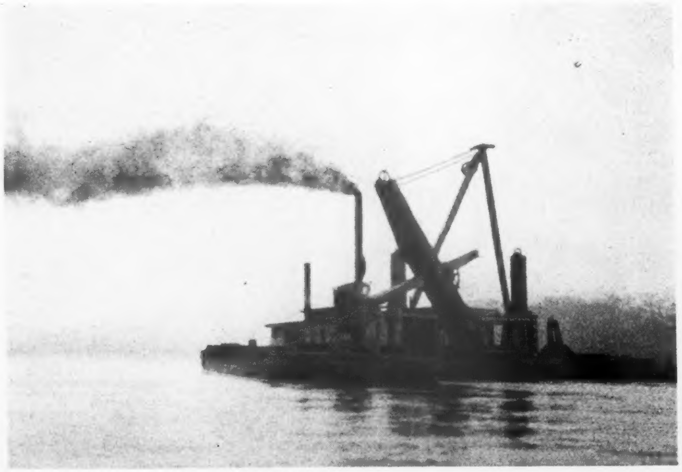
Tennessee River Plant at Chattanooga Uses Large Dipper Dredge and Has Other Special Features

SOMETHING over five years ago the Dixie Sand and Gravel Co. (then a subsidiary of the Dixie Portland Cement Co.) built a plant at Chattanooga, Tenn., which attracted a great deal of notice on account of the extremely substantial construction that had been employed and the high grade of equipment which was installed. It was described shortly after it was built in ROCK PRODUCTS (issue of June 16, 1923). The design being good and the construction of such a substantial nature, no very radical changes in the plant itself have been found necessary. But it has been found advisable to make some important changes in the method of excavating the material and some minor changes in the washing and screening of the material.

Derrick-Bucket Dredges Abandoned

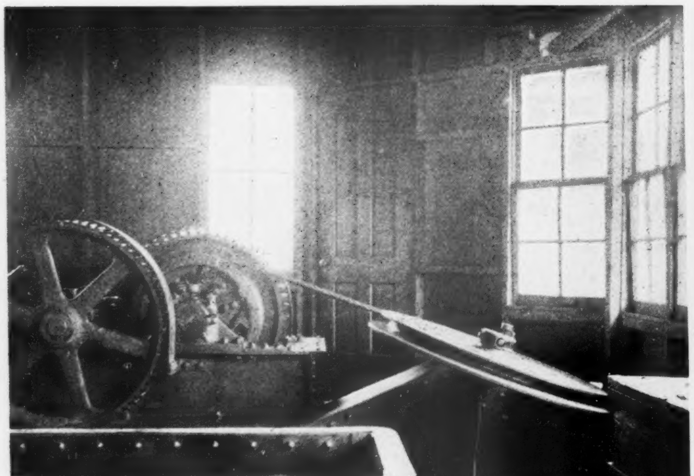
Originally the crude material, which comes from the bed of the Tennessee river near Chattanooga, was excavated by a bucket dredge or "derrick boat," as this machine is generally known on the Tennessee. Both clamshell and orange peel buckets were tried. The clamshell worked well enough where the ground was soft, and the orange peel handled the hard ground after a fashion. But neither was quite satisfactory. The bed of the river is not cemented at all, but it contains such a mixture of cobbles, gravel, sand and a little clay that it is very low in voids and packs under the pressure of the water, and action of the current, until it is about as hard to dig as a well-made macadam road would be. When the bucket dug a hole, the sides would not cave, in the really hard places. Each bucketful had to be obtained by forcing the prongs of the orange peel down into the hard-packed material and taking what the bucket would get.

After studying the matter thoroughly and observing the work of different kinds of dredges all over the country, the company finally decided to install a dipper dredge of the type used by the United States government and by contractors in dredging chan-

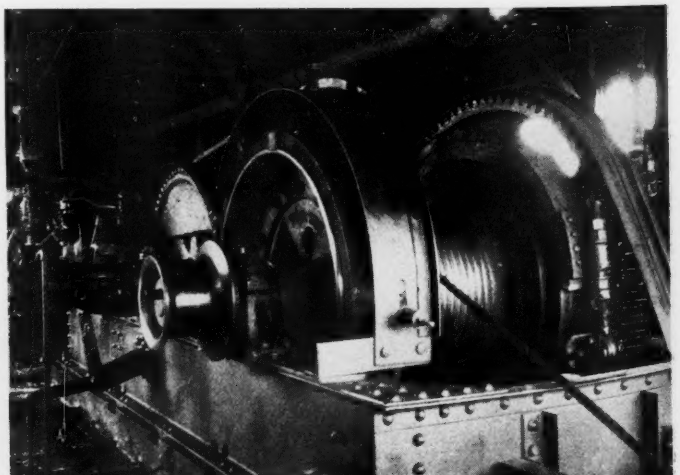


Dredge working on the Tennessee river

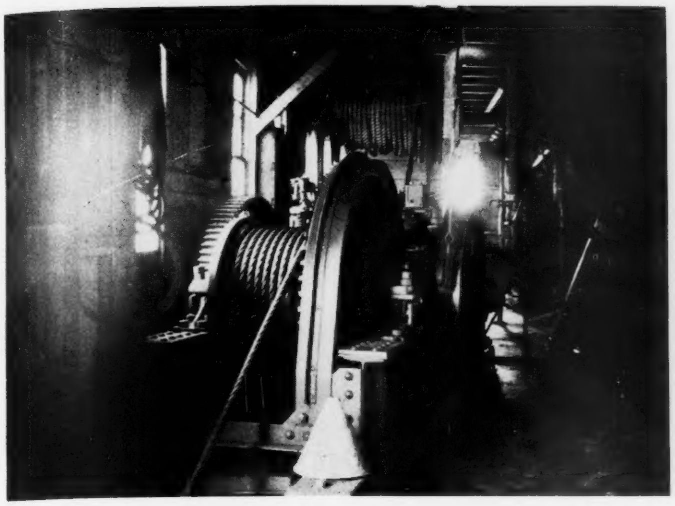
The 2 1/2-yd. dipper of the dredge discharging on a barge



The swing-engine of the dredge with angle sheave for the swing cable



Main engine of the dredge with digging line drum in front—the "back line" drum shows in the rear



One of the two spud engines

Dredge crew, A. C. Lawson, foreman, at the left

nels in navigable rivers. Such machines had been very little used in the sand and gravel industry, and where they had been tried they had usually been abandoned. The smooth and easy working of the pump dredge and the high capacity and fairly good digging ability of the ladder (or bucket line) dredge have caused one or the other of these to be preferred wherever dredging is used to win the material.

But the company decided that a dipper dredge was the only solution of its problem and had such a dredge built for it by the Bucyrus Co., which has built dredges of all types for work all over the world. This dredge was planned and built not only with a full knowledge of the conditions of digging but with a knowledge of the needs of the sand and gravel producer, the Dixie company co-operating with the builders in this way.

The dredge was put in service in 1925 and was briefly described in the Annual Review number of ROCK PRODUCTS for that year. It has now been in service long enough so that it can be said that it has done all that was expected of it and more. Its success has caused so much comment that it has attracted the attention of producers in other parts of the country and some of them (notably from points on the Ohio, where hard digging is encountered) have visited the dredge and watched it work.

It has been prophesied that this type of dredge may supersede to some extent both the bucket dredge and the ladder dredge, for it is a better digger than the bucket dredge and it costs less, for a boat of the same output, than a ladder dredge. Also the machinery is somewhat simpler than that of a ladder dredge and the repair bill would probably run lighter. Two other dipper dredges are working on the upper Tennessee, both at Knoxville, and the companies that operate them say they prefer this type to any other kind for the work that has to be done.

Dredge Described

The hull of the Dixie dredge is 95 ft. long and 34 ft. wide. It is all of steel plate, in fact the only wood used is in the superstructure which covers the machinery. It is steam driven, for it is generally admitted that the characteristics of steam power are better adapted to the kind of digging to be met than those of any other kind of power.

The 125-hp. boiler that supplies steam for all the engines is placed well aft along the center line. It is of the locomotive firebox type and is fired with coal. Forward of the boiler and toward the sides are the two spud engines which handle the forward spuds. In front and along the center line is the main engine. This has a drum for handling the main dipper line and a drum for the "back line" (a device peculiar to dipper dredges and not needed on steam shovels, which they so much resemble in other ways). To the left of the main engine, looking forward, is the swing engine, and at a similar position on the right is the operator's rack of levers.

The boom is 52 ft. long and very solidly constructed. It holds a seat for a crane man, as on a railroad type steam shovel, but he has no crowding engine to attend to. The engine on the boom is only to open and close the bottom of the dipper. The dipper stick is 58 ft. long and is of wood reinforced with steel, made as steam shovel dipper sticks are made.

In operating, the dredge is first moved to its new position by dropping the dipper and

The 15-ton derrick which unloads barges and the operators cabin

An unusually large clam-sheel bucket used in unloading barges

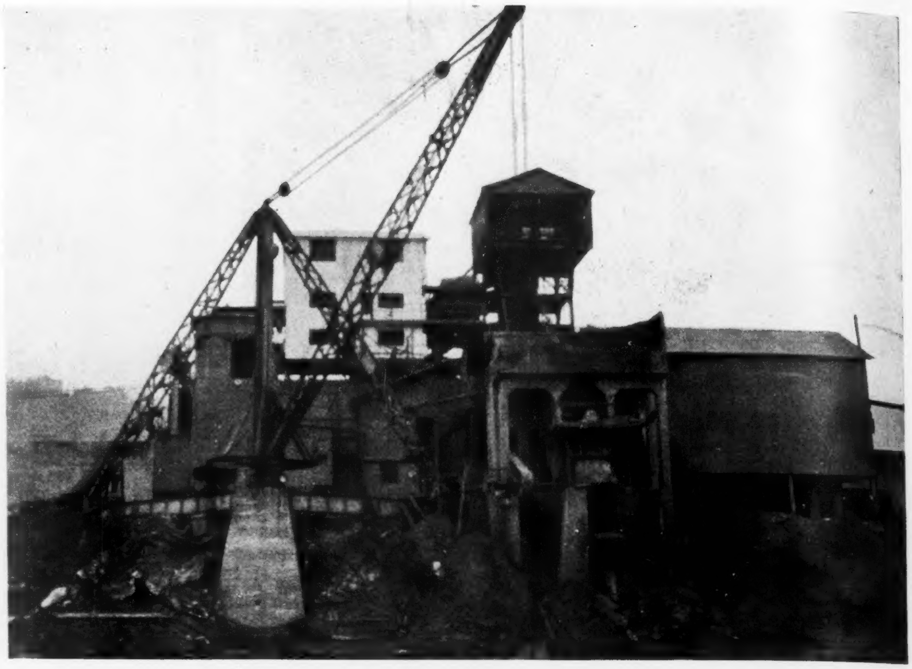
pulling on the back line. The dipper acts as an anchor so that the dredge is pulled forward. Handled in this way the dredge has considerable mobility and it could move itself almost anywhere, although the progress would be slow. But it is fast enough for all the movement needed after the digging ground has been reached.

The next move is to "pin up" the forward spuds by pulling on the line passing over the sheave at the top, so that the spuds take some of the weight of the boat. The rear spud is not pinned up but is almost always left free to trail along when the dredge is being moved. It helps then to keep the dredge from swinging in the current. It also helps to steady the dredge while digging. These spuds are 24x30 in. in one piece and of heavy timbers with 6-in. angle irons on all four corners.

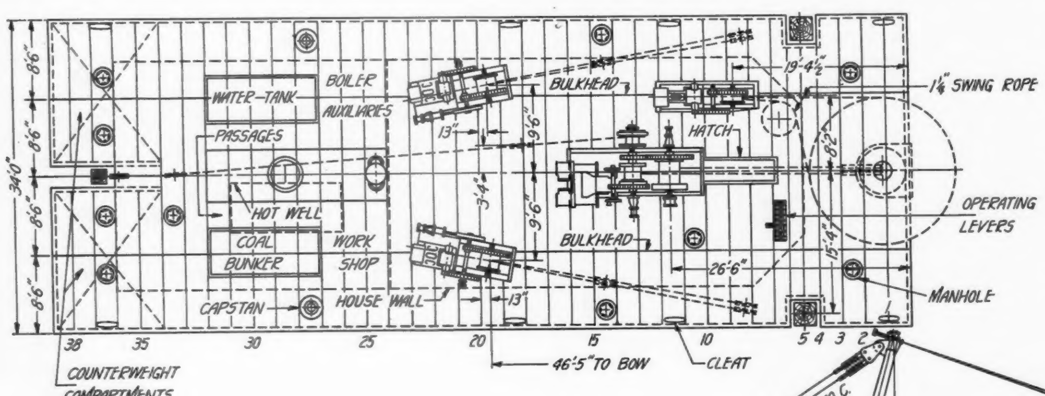
The dipper is then pulled back toward the boat by the back line. If it were not pulled back it would hang straight up and down and could get no "bite" on the ground. Being pulled back it goes lower as it swings on the arc of a circle and hence it digs into the ground and is held to its work by the weight of the dredge. This action takes the place of "crowding" on a steam shovel.

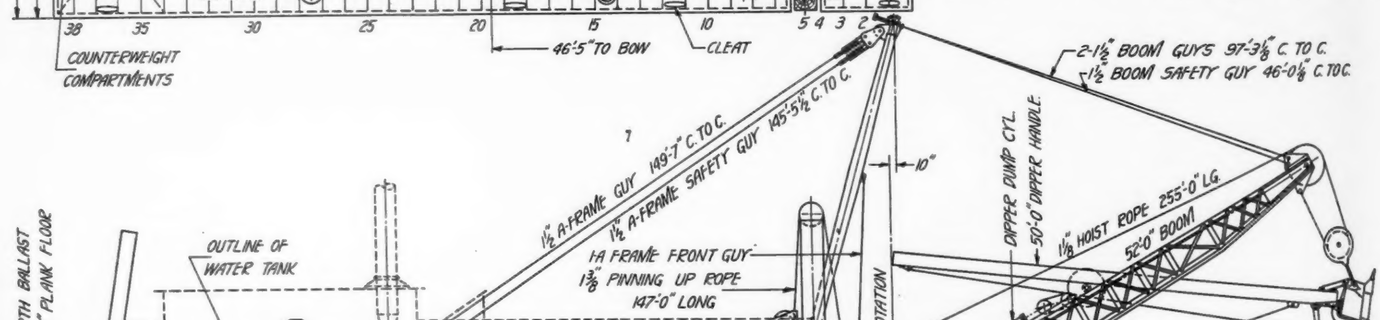
The dipper with its load of 2½ yd. is then brought to the surface and lifted and swung over the barge where its load is dumped. With such wet material nothing sticks in the dipper and there is no need of slamming the door, as there often is with a steam shovel dipper, to free any adhering material. The dipper is closed, swung back and dropped for a new load in about the time it takes to tell about it.

The digging is much faster than one would believe. The barges used by this company (with one exception) hold 175 tons. And the record time for filling one of them is 14 minutes. This figures out a little over 3 swings per minute, but no such pace can be



The plant seen from the river. The unloading hopper and crusher show in the foreground





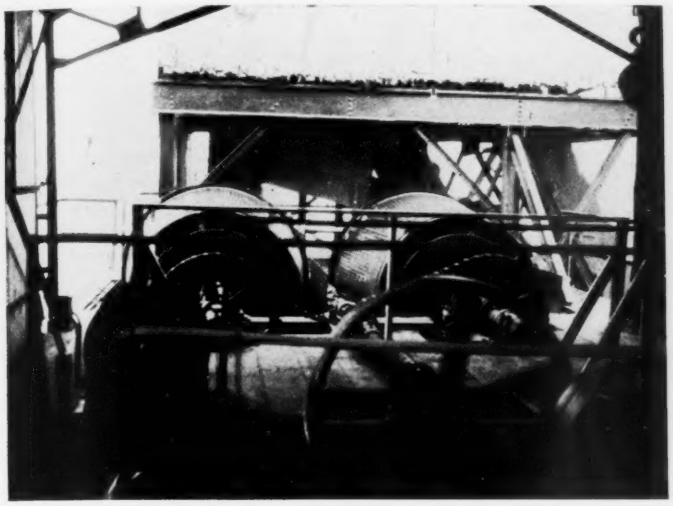
General plan and elevation of the dredge operated by the Dixie Sand and Gravel Co.

maintained steadily. Barges are more often filled in 20 minutes and in 30 minutes when the digging is hard. With average digging the capacity of such a dredge would be something over 4000 tons for a 10-hour day. This would seem a very satisfactory output when the nature of the material is considered.

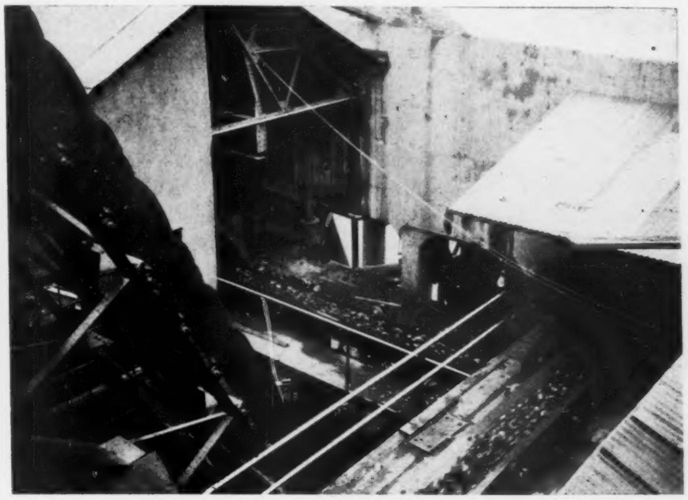
The barges used are all of the flush deck type and all but one are of wood. They have cargo boxes with rather low sides, about a foot in height. The exception noted is a steel barge which was built last year as an experiment and it has not proven altogether a success. It was built along the regular lines for such barges and allowance was not made for the very large and heavy bucket used to unload barges at the plant. In consequence the deck beams were bent and will have to be braced or replaced by heavier beams. Otherwise the steel barge has proven satisfactory, as such barges have elsewhere.

There are two boats employed in towing, one steam-driven and the other powered by a 120-hp. Fairbanks-Morse full-Diesel engine. The latter had just been put in service and some slight changes were being made on it when the plant was visited. It is a stern-wheel boat, the wheel being 11 ft. in diameter and 12 ft. long.

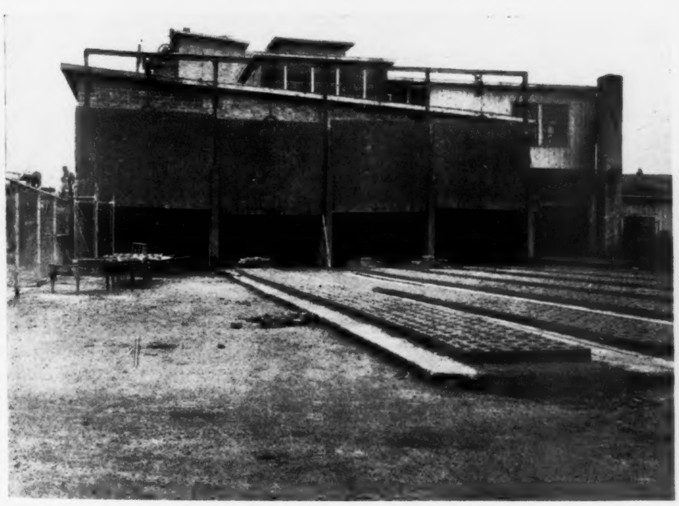
For unloading barges the plant has an American derrick with a 33-ft. mast and 65-ft. boom. It is rated at 15 tons and handles a 3-yd. special Hayward bucket, which weighs 9000 lb. This bucket is designed with a view to cleaning up the deck with as little shovel work as possible.



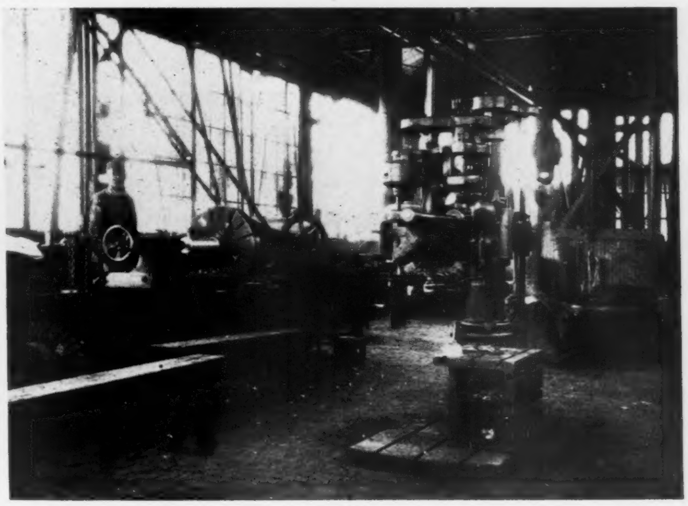
Conical sizing screens substituted for the cylindrical screen



Pan conveyor and cross belts feeding the crushing rolls



Cement products plant which has been changed to make "stonetile"



All but the heaviest repairs are made in this plant machine shop

Plant Changes

As the description of this plant has been published before, only those features which have been changed will be described in detail. The first of these, the grizzly which was originally a bar grizzly is now replaced by a "Cataract" grizzly made by the Robins Conveying Belt Co. It is 36 in. wide and has 9-in. rolls and handles the material easily and without giving any trouble. This grizzly was installed about a year ago.

Oversize from this grizzly goes to a 16-in. McCully crusher and the crusher discharge and grizzly undersize go to a 30-in. pan conveyor, set about 60 deg. from the horizontal, which elevates the material to the screens at the top of the plant. Here another change is noted. Originally all the screening was done by a large cylindrical screen with a jacket, like the screens used in crushed stone plants. This has been taken out and four Gilbert screens (made by the Stephens-Adamson Manufacturing Co.) have been installed. They are the largest made of this type of screen, 84 in. in diameter at the large end. Each screen is supplied by four washing jets coming from flat nozzles and the washing is unusually thorough, only clean water coming through with the gravel.

The main reason for changing the type of screen was to make the plant more flexible. With the old screens it took about three hours to change the screen plates, when certain mixed sizes were made. Now the change can be made one way without stopping the feed and the other way by stopping it just long enough for the chutes to clear.

These screens are in pairs. The upper pair, between which the feed is divided, has

$2\frac{1}{2}$-in. perforations in the inner jacket and $1\frac{1}{4}$-in. in the outer. The oversize of these screens goes by a chute and two conveyor belts to a pair of 54-in. by 24-in. Allis-Chalmers rolls, which serve as a secondary crusher. The undersize of these screens go to two more Gilbert screens of the same size with $\frac{5}{8}$-in. and $\frac{1}{4}$-in. perforations.

Experience with Roll Crushers for Gravel

This is the only plant of which the writer knows in which rolls are used as regular crushers for gravel, although they are used to crush gravel down to sand size in at least one other plant. Their use is so unusual that some information was asked concerning their work. Chester Padgett, the superintendent, said that they were not only well liked, but that he personally thought them better than any other type of crusher for the work they had to do. The rolls are the standard type used in crushing ore, and the shells are of chilled iron. Manganese steel was tried but proved unsatisfactory. The rolls would not "nip" properly with shells made of it. Shells last three to four months, after which the chilled portion is worn through. The softer iron underneath wears so rapidly that it pays to discard the shells rather than to wear them thin. The babbited bearings have lasted over two years. The rolls have replaced a No. 6 McCully crusher and are considered better for the work they have to do.

Land side of plant—note the runaway and crane which handles material for truck delivery

The crane loading from plant bins to truck bins

Sand-Recovery Tanks

The sand-recovery tanks are also new, having been installed this year. They are of the tilting type, the sort in which the outlet swings away from a block when the tank is filled with sand. They are 8 ft. square on top and of something over 8 ft. in depth. The discharge goes to a screw conveyor which also acts as a dewaterer and takes the sand to the bin.

The regular plant bins are set over a track and fitted with segmental gates so that railroad shipments may be loaded directly into cars. These bins are filled in a rather unusual way, there being a belt conveyor for each size from the screens except the coarser sizes. The belts are of different lengths as required by the position of the bins.

Materials to be delivered by truck are taken by a McMyler-Interstate electric locomotive crane and placed in truck loading bins. In the summer the truck deliveries are heavy, often running 500 to 600 tons per day. The crane also delivers material to a belt that makes stock piles.

This crane runs on a track set on walls of concrete high above the ground, which gives the plant an appearance unique among sand and gravel plants.

All the machinery is electrically driven and all but one or two motors are of General Electric make. Following are the horsepowers of the principal motors: On the 16-in. gyratory crusher, 150 hp.; on the rolls, 125 hp.; on the pan conveyor, 40 hp.; and on the four screens, 40 hp. (driving through a belt and gearing followed by chains). The derrick has a 175-hp. motor working on a two-part line, and a 25-hp. motor on a single line for the swing.

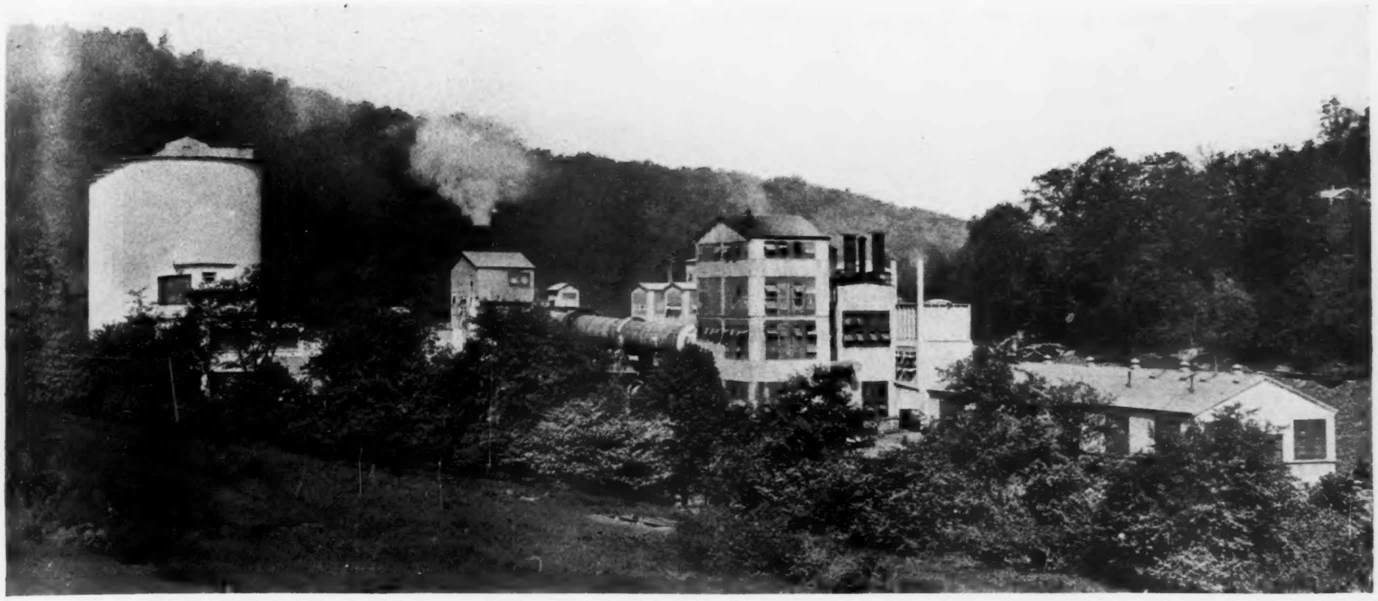
A cement products business is run in connection with this plant and in the past year it has changed over from making the ordinary tamped block to make "Stonetile," a poured block. This form of masonry unit is very popular in the southern states and the change has resulted in a large increase in the demand for the plant's product.

Diesel powered tow boat and barges

Special Cement Panels Kill Echoes

EMILE BERLINER, inventor of the microphone, believes that he has solved the problem of acoustics, long the bugbear of builders of theaters, churches and concert halls. Working on the principle that acoustics were almost always good in halls lined with wood, he has perfected a means by which cement or stone-covered walls may acquire the desirable resonant qualities.

Mr. Berliner proposes to cover the walls with hollow wire discs or cells, following which these are covered with the special "acoustics" cement and decorated to harmonize with the interior. These smooth panels are as vibratory as the sound board of a piano and highly responsive to sounds. *Detroit* (Mich.) *News.*



General view of West Penn Cement Co.'s plant at West Winfield, Penn.

West Penn Cement Plant Now Operating

New Plant of West Penn Cement Co., West Winfield, Penn., Is Simplicity in Highest Degree—More Than 2000 Bbl. per Day From One Kiln

By George M. Earnshaw

THE West Penn Cement Co.'s plant at West Winfield, Penn., turned out its first finished cement in March, before all construction work was completed. At the time of the writer's visit recently, there were still a few details to be attended to, but for the most part the plant was "a finished job," and was making and shipping a good quality product.

There is nothing elaborate in the plant's design. As for novel features, there are none; it is notable for simplicity. This should not be construed to mean that the plant is cheap or that construction details have been stinted, for such is certainly not the case. In the judgment of its designers, the very best of materials and equipment were installed throughout, regardless of first cost.

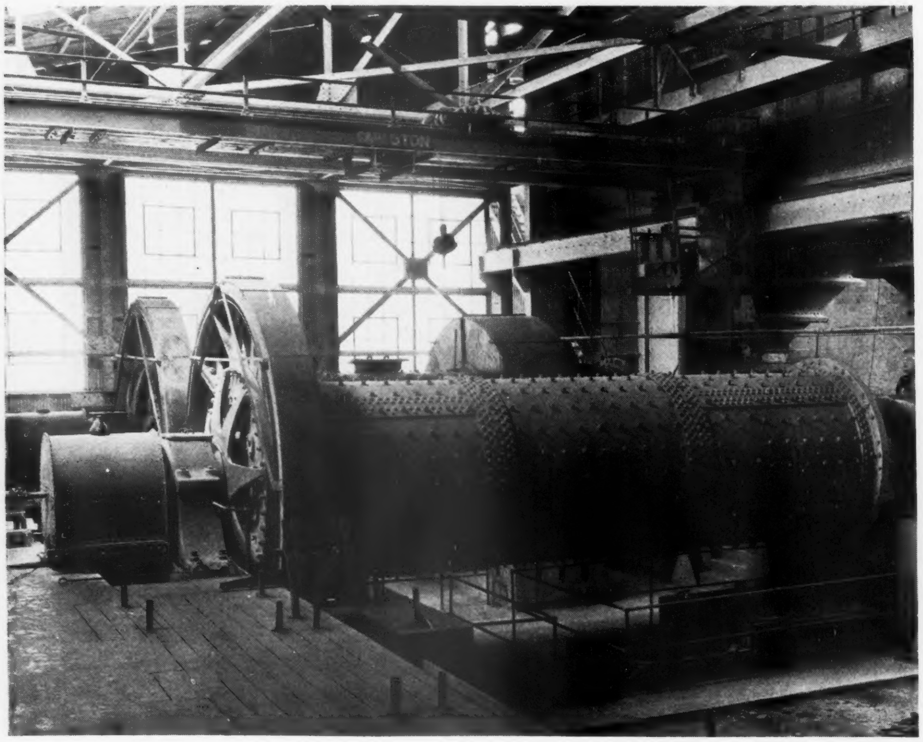
A vital point in the plant's design is the thoroughness with which provisions were made for enlarging it. This is noticeable almost everywhere, for small and large units alike. Wherever practicable, equipment larger than actually necessary for present requirements was installed, such as elevators, conveyors and the various storages. As far as the designing was concerned, it was really a task of laying out a three-unit plant of 6000-bbl. capacity, each unit complete in itself, yet an integral part of a big plant.

The man responsible for the general plan of the plant is O. J. Binford, who is, and has been, general manager of the company since its incorporation. Mr. Binford was formerly secretary and plant manager of the Southwestern Portland Cement Co. at El Paso, Texas, and later at Osborne, Ohio, where he had a chief part to play in the building of Southwestern's newest plant. After completing a preliminary design for the West Penn plant, Mr. Binford employed the services of M. D. Jones, engineer of the Fuller-Lehigh Co., which executed the working drawings. Mr. Jones stayed on the job as consultant until the plant was completed.

Raw Materials

The West Penn Cement Co. has on its property a limestone mine (said to be the oldest in this country), which has been operated for more than 50 years. The output of the mine has been sold for commercial purposes, the old company having operated a crushing plant on the property. As rapidly as possible the mine is to be re-equipped with electric shovels and electric locomotives and drills. Construction has already started on a new crushing plant, which will not only serve the cement plant but will also take care of the district's demand for commercial stone. (The mine and new crushing plant will be described in a subsequent issue of ROCK PRODUCTS.) At the present time the old crushing plant is keeping the cement

Kiln tanks in foreground; blending tanks at left



Raw-grinding mills. They are 8 ft. in diameter, 30 ft. long

plant supplied with stone. In addition to the plentiful supply of limestone, the company also has on its property coal, shale and siliceous shales, so that gypsum will be the only raw material to be shipped in.

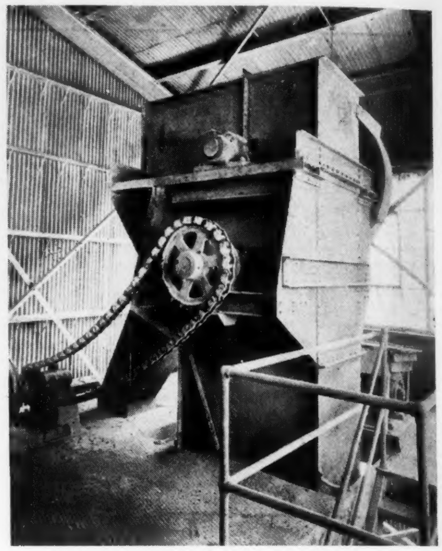
Raw Grinding Department

Stone (reduced to 5½ in. and smaller) is hauled from the crushing plant to the raw end of the cement plant in standard-gage 25-yd. air-dump Koppel cars by steam locomotives and is dumped into a track hopper. Storage for stone and shale parallels the track on either side, and a 25-ton Link-Belt crane with 60-ft. boom reclaims the materials from storage.

Under the track hopper, in a concrete tunnel, is a 30-in. Republic conveyor belt of 70-ft. centers, mounted on Jeffrey plain-bearing Alemite-lubricated idlers, spaced 4 ft. apart. There are four spouts from storage through which this conveyor is fed, and this one conveyor and one crusher handle both the stone and shale, individually, of course. The preliminary grinder is a 42x48-in. Jeffrey Type B swing-hammer pulverizer, directly driven by a 125-hp. Allis-Chalmers motor through a Francke flexible coupling. (All motors in the plant, unless otherwise stated, were furnished by Allis-Chalmers Manufacturing Co., Milwaukee, Wis.) The conveyor is belt driven from the hammer-mill motor's shaft.

The crusher reduces the raw materials to ⅝ in., 85% of which is ¼ in. and smaller, and this is moved to the elevator in an 18-in. screw conveyor, 8 ft. long, driven by a 10-hp. motor through a 900 to 64 r.p.m. James speed reducer. (All speed reducers excepting those in the stock house were furnished by the D. O. James Manufacturing Co., Chicago, Ill.) The elevator is of the enclosed chain-bucket type, double buckets, size 14x9x11¾ in., furnished, as were all the chain, buckets and conveyors, by the Jeffrey Manufacturing Co., Columbus, Ohio. It is chain driven by a 40-hp. motor through a 900 to 140.5 r.p.m. reducer. The elevator discharges into an 18-in. screw conveyor chain driven by a 20-hp. motor through a 900 to 112.5 r.p.m. reducer which in turn discharges into two bins over the raw-grinding mills.

The bins are of steel construction and each is divided into two sections, one section for stone, the other for shale. Each bin



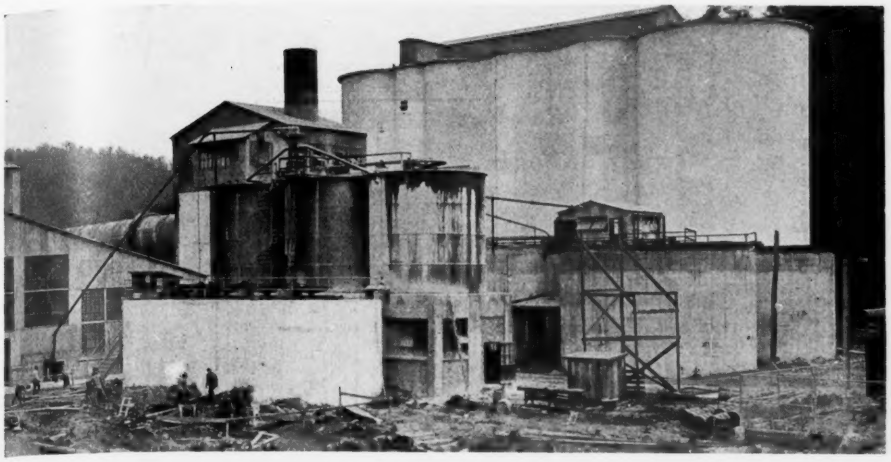
Top of raw material elevator. The drive is typical of all drives throughout the plant

has a capacity of 200 tons of stone and 100 tons of shale. From these bins the stone and shale feed is regulated by a specially designed feeder of the overlapping pan type, manufactured by the Webster Manufacturing Co., Chicago, Ill., and which is driven by a 3-hp. motor through a gear reduction unit. The feeders are said to be positive and unusually regular in their operation.

As mentioned above, the plant is now only

These compressors furnish air for the whole plant

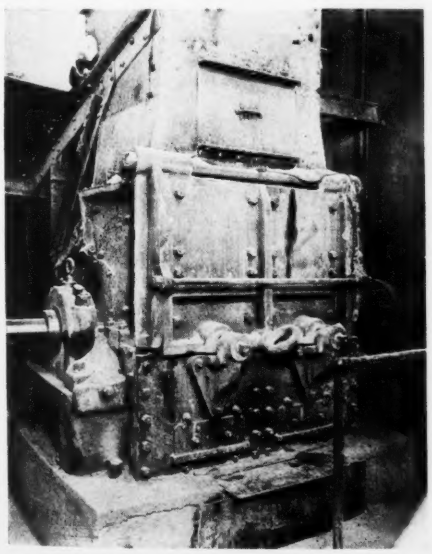
800-hp. synchronous motors driving the raw-grinding mills



A good view of the agitating basin, blending tanks and kiln tanks

a one-unit operation, and to insure the necessary production, two compeb mills for raw grinding are installed. These are unusually large, 8 ft. in diameter by 30 ft. long, and each is driven by an 800-hp. synchronous motor through a 72-in. Cutler-Hammer magnetic clutch. The mills, the kiln and cooler were furnished by Allis-Chalmers Manufacturing Co. Allis-Chalmers' "Concavex" grinding media are used in the finish mill and one of the raw mills, and Jeffrey's "Manganoid" is used in the other raw mill.

The building which houses the raw-grinding mills and motors also houses the finish-grinding mill. Provision has been made in



The 42x48-in. swing-hammer mill

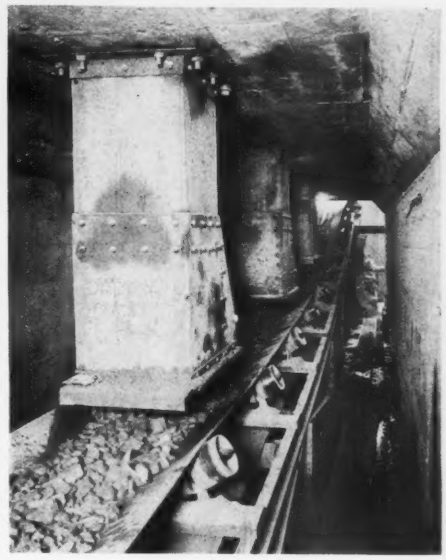
this building for the future installation of three additional grinding units, which will be identical to those now installed. Also in this building are the switchboard and air compressors. The switchboard is the General Electric Co.'s latest design, dead front type, remote controlled. The air compressors were furnished by Ingersoll-Rand Co. and are Class "PRE-2," each driven by a 206-hp. General Electric motor. Both are equipped with Richardson-Phenix Co. force-feed lubricators. A 5-ton standard Northern overhead electric traveling crane is mounted over the mills, and a similar crane is installed in the other half of the building, used for making repairs on the synchronous motors, air compressors and switchboard.

Slurry Handling and Storage

Slurry is pumped from the basins under the grinding mills by two No. 4 Wilfley pumps, each driven by a 20-hp. motor, to three steel blending tanks of 720 bbl. capacity each. These tanks are located on top of concrete walls which serve as an oil and grease storeroom on one end and an electrical repair shop on the other end.

From the blending tanks the flow of the slurry is regulated by valves to a concrete agitating basin of 2268 bbl. capacity. This tank is provided with four F. L. Smidth agitators, driven by a 25-hp. motor through a speed reducer. Merco-Nordstrom valves are used throughout the plant where frequent opening and closing or regulation of the flow is required. Where only occasional operation is necessary, Fairbanks valves of the ordinary type are used for the purpose.

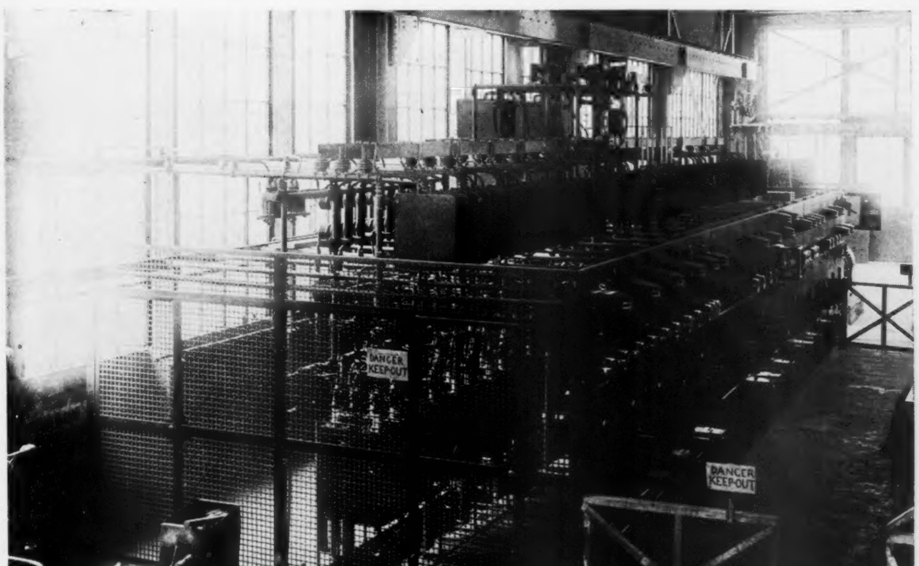
Slurry is moved from the agitating basin by another No. 4 Wilfley pump (driven by a 30-hp. motor) to four circular concrete storage, or kiln-feed tanks each of 3600 bbl. capacity and equipped with Dorr agitators. Here again two No. 4 Wilfley pumps pick up the slurry and pump it to the kiln. These two pumps are located in the center of the



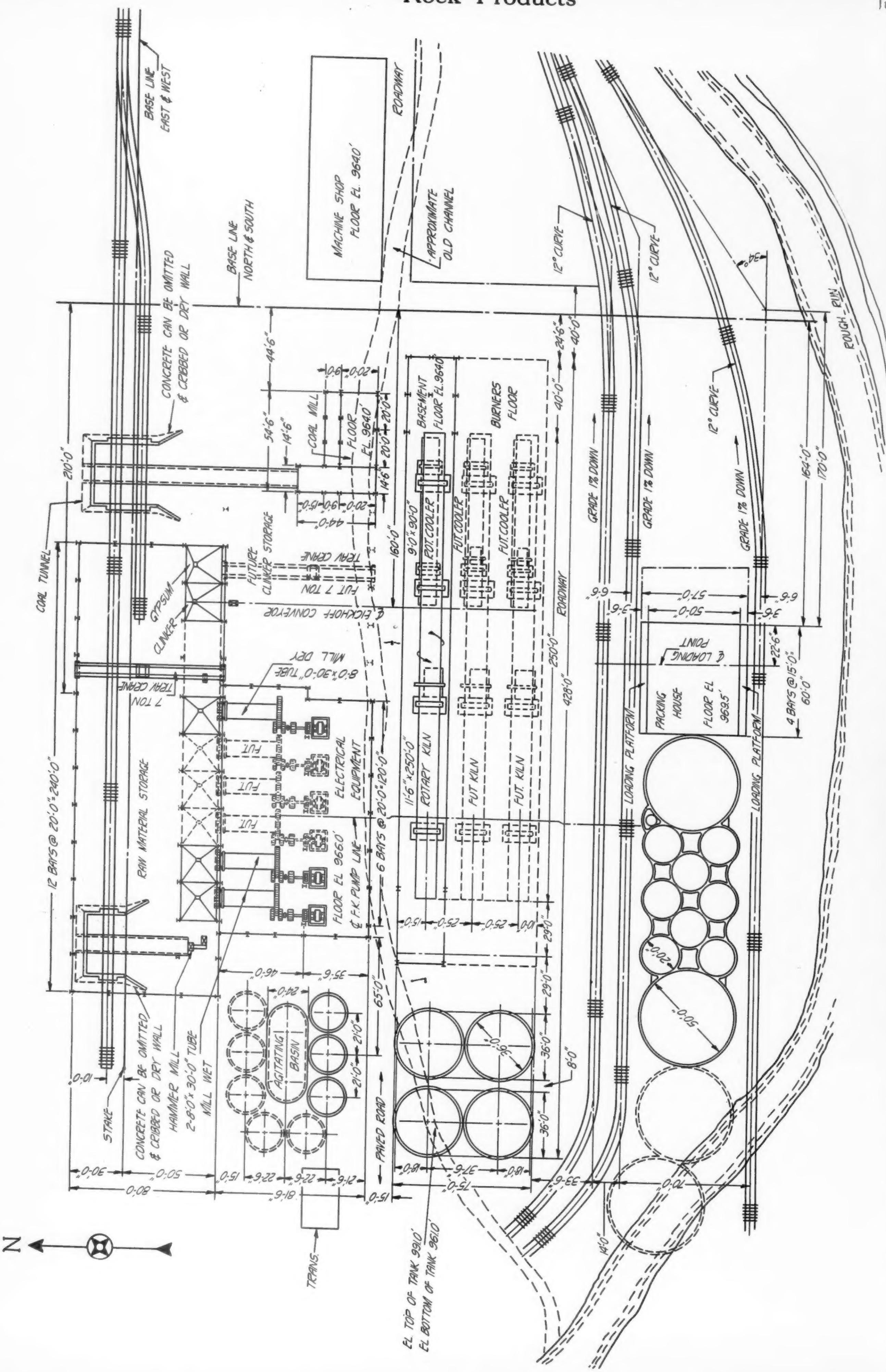
Raw material conveyor

square formed by the four tanks which are arranged in two pairs. The pit is drained by a 3-in. American Well Works pump driven by a 10-hp. motor.

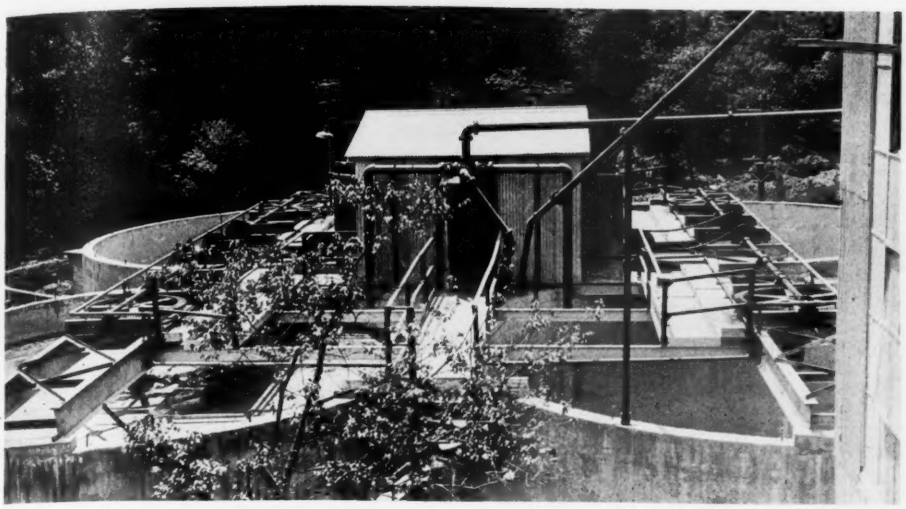
An Allis-Chalmers high-speed, single-stage pump with a 3-in. suction and 2½-in. discharge is responsible for the plant's water supply. It furnishes 250 g.p.m. under a head of 155 ft. to a steel tank of 50,000 gal. capacity. The pump is driven by a 20-hp. 1800-r.p.m. induction motor. The water is



Dead front, remote controlled switchboard



Ground plan. Note the provisions made for future enlargement. It is planned to change the course of the creek for the installation of additional silos

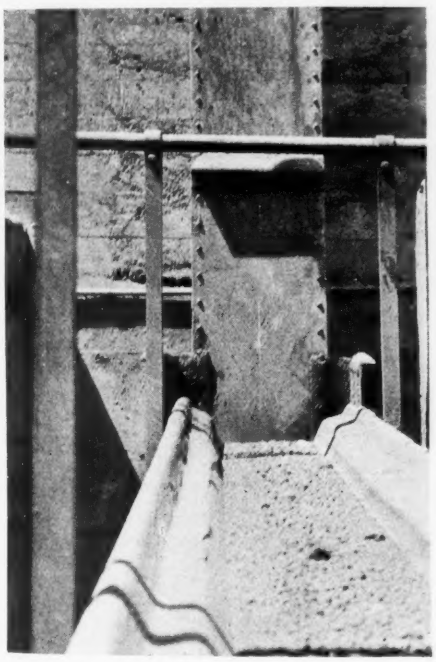


These four kiln-feed tanks have a combined capacity of 14,400 bbl.

distributed through 4-in. lateral lines from a 6-in. line from the tank.

Kiln and Cooler

A 4-in. line carries the slurry to the kiln and the overflow is returned to the kiln-feed tanks in a 6-in. line. Slurry is fed to the kiln by a Traylor ferris-wheel feeder. Later, however, a spray slurry-feeding system will



Steel jigging conveyor receives clinker from cooler

be installed, which will no doubt be the first installation of its kind in a cement plant in America. The system is patented by the Industrial Driers, Ltd., of London, England, and manufactured in the United States by the Allis-Chalmers Manufacturing Co. A considerable increase in both capacity and economy is expected. The kiln is served by a Green Fuel Economizer Co. exhauster with double inlet. The latter has a capacity of 135,000 cu. ft. of air per minute at 700 deg. F. The exhaust of the fan is 8 ft. 6 in. in diameter extending only a few feet above the roof line and it expels practically no dust.

Pulverized coal from the coal plant is discharged in a 50-ton steel bin and is fed to the kiln through two 12-in. lines by two Bailey meter feeders; furnished by the Fuller Lehigh Co. These feeders are of the revolving table type and their operation seemed to the writer to be unusually regular, affording a positive and uniform feed. They are said to be the first of their kind to be installed in a cement plant. Up to the time of our visit, it had been estimated by officials of the plant that the coal consumption was in the neighborhood of from 110 to 115 lb. of coal per barrel of clinker.

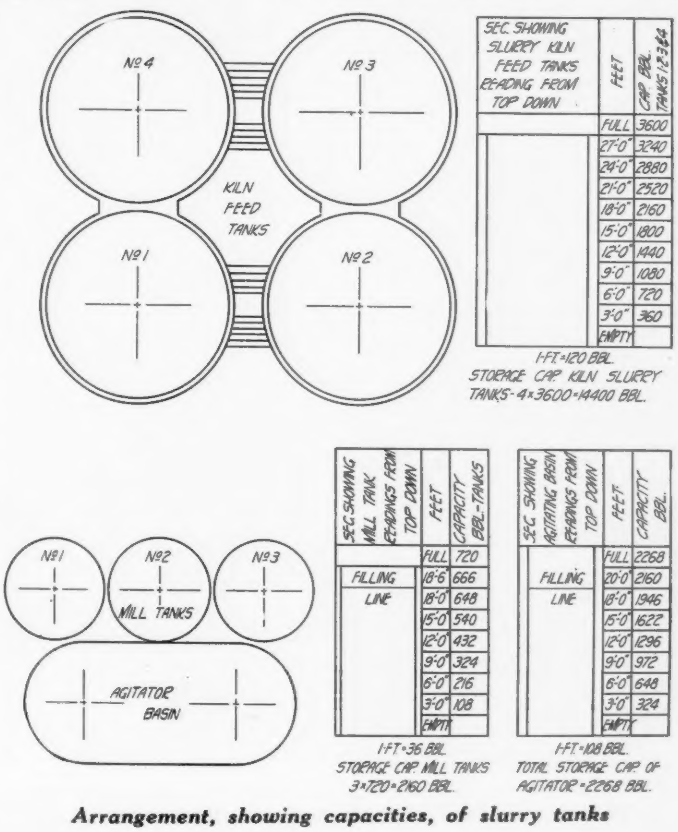
The kiln is 11 ft. 6 in. in diameter and 250 ft. long, driven through gears by a 100-hp. motor. Its maximum speed is one revolution in 1 min., 52 sec., but it has been found that it can be run faster and gears have been ordered which will permit it to run as fast as one revolution in 1 min., 13 sec. The kiln rolls on 25-in. tires and 27-in. face rolls. It was equipped with more than one mile of chain by F. L. Smidth and Co., and has no tumbler bars. Its rated capacity is 2000 bbl. per day but this output is said to have exceeded on several occasions.

The cooler is mounted directly under the kiln. It is 9 ft. in diameter and 90 ft. long, gear driven by a 40-hp. motor. Its discharge end is equipped with a 36-in. wide section of perforated screen with 1¾-in. openings. A retaining ring, 15 in. wide, also with 1¾-in. openings, is fitted in the end. Clinker passing through the screen is received on baffles which afford a discharge from the top. This feature permits a somewhat

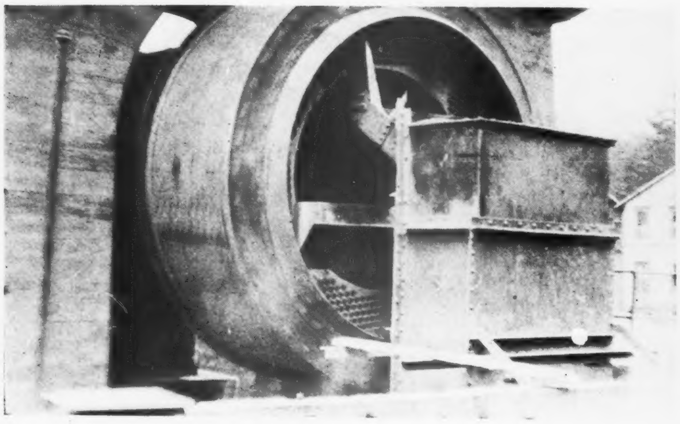
Something new in kiln coal feeders

quicker cooling, and it is estimated that the enlarged end makes the cooler the equivalent of 9x100 ft. Clinker retained on the screen stays right there until it wears itself down small enough to pass through. Any foreign matter, such as a piece of brick from the kiln liner, can be removed by hand.

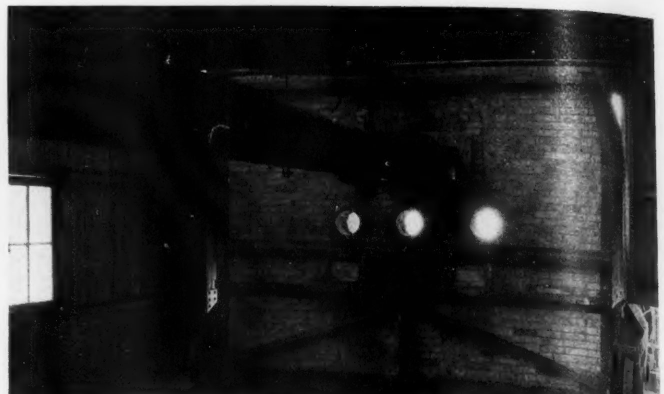
The clinker discharges into a steel box



Arrangement, showing capacities, of slurry tanks



The cooler discharges from the top



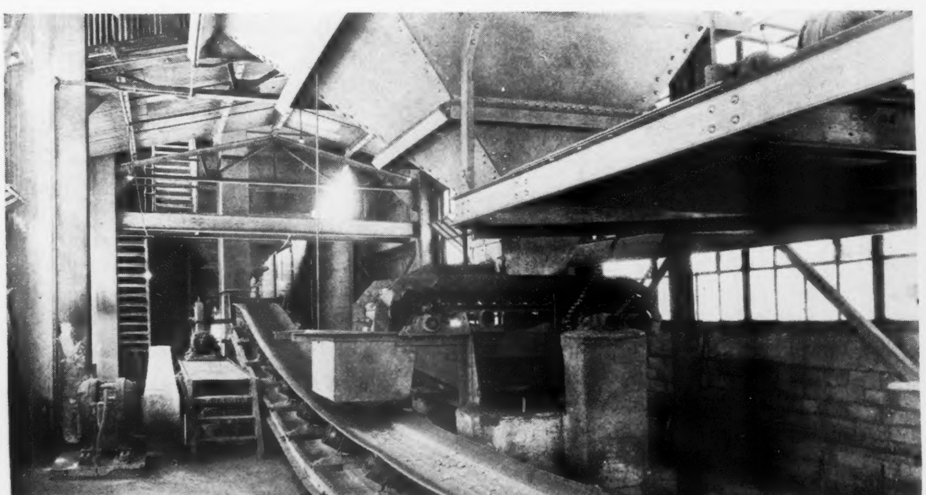
Firing end of kiln

Slurry pumps located between kiln-feed tanks

from which it is fed to an Eickhoff steel wave-motion jigging conveyor, furnished by the Conveyor Sales Co., Inc., 299 Broadway, New York City. This conveyor consists of a series of troughs rolled backward and forward with an accelerated and retarded reciprocating motion, produced through a special patented driving arrangement by a small motor. The trough is mounted on rollers which run in a sort of curved cradle. Although this conveyor is operating on a level, it is said that it can convey on grades as steep as 8 deg.

Finish Grinding Department

The clinker conveyor empties into an enclosed chain-bucket elevator which in turn discharges into a chute leading to a steel bin. At the present time this is the only clinker storage provided for but upon final completion of the plant there will be ample outside (covered) storage space. Feeding from the bin is accomplished by a Webster over-lapping pan feeder. Gypsum is placed in a steel bin (identical to clinker bin) from outside storage by a locomotive crane and it is fed with the same kind of feeder that



Clinker and gypsum conveyor in finishing grinding department. The feeder is of the overlapping pan type

Same as picture on left, but from opposite end. The 54x20-in. roll crusher shows in foreground

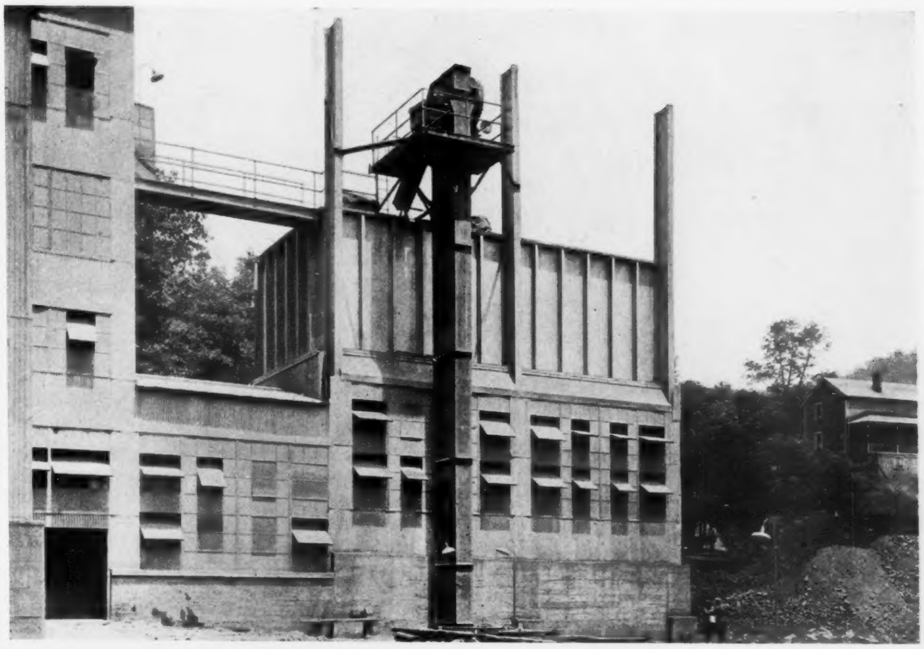
handles the clinker. These two feeders are chain-driven by a 5-hp. motor through a 1150 to 143.5 r.p.m. speed reducer.

The gypsum and clinker are discharged from the feeders to a 30-in. Republic belt conveyor of 70-ft. centers which empties into a 54x20-in. Traylor roll crusher, belt driven by two 40-hp. motors. The crusher's output goes into an enclosed chain bucket elevator and from the elevator to a spiral conveyor which empties into a steel tank mounted over the finish-grinding mill.

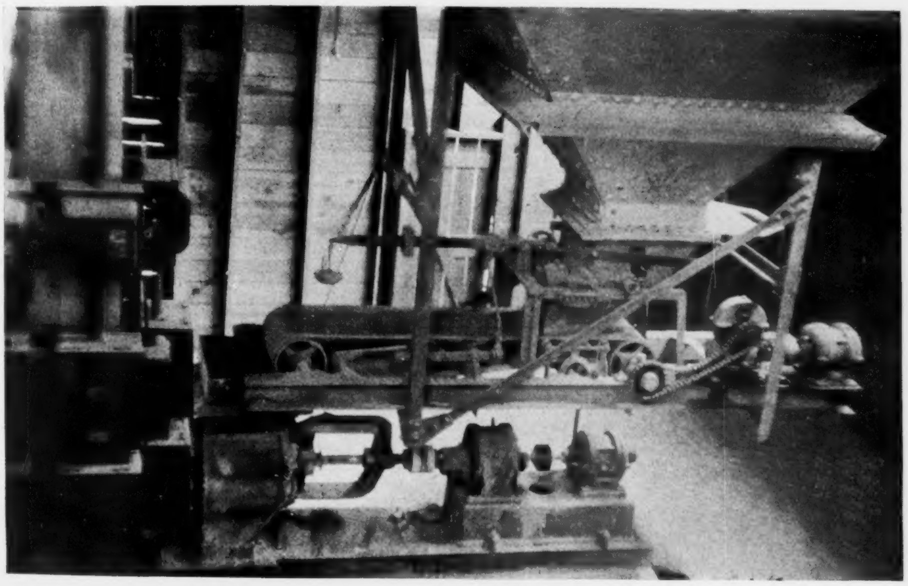
The material is fed to the mill by a 20-in. by 4 ft., 6 in. Schaffer poidometer, driven by a 3-hp. motor through a Fawcus Machine Co. speed reducer. The feed screw directly serving the finish-grinding mill is driven by a 3-hp. motor through a James speed reducer. The mill, like the raw mills, is a compeb driven by an 800-hp. synchronous motor through a 72-in. magnetic clutch.

Silos and Packhouse

Cement is pumped from the finish-grinding department to the silos by the Fuller-Kinyon system; the pump is driven by a 50-hp. motor and the material is moved in a 6-in. line.



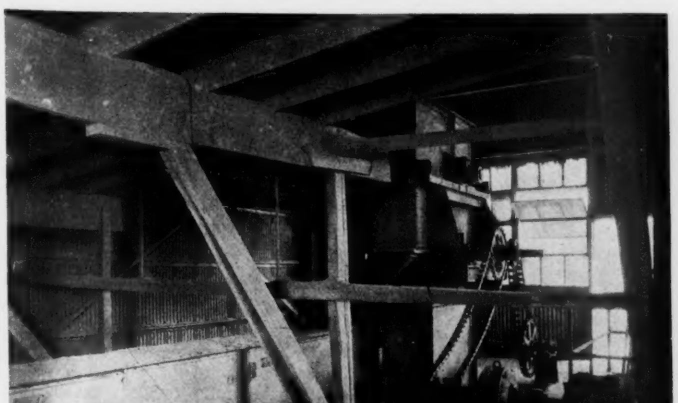
Finish grinding department



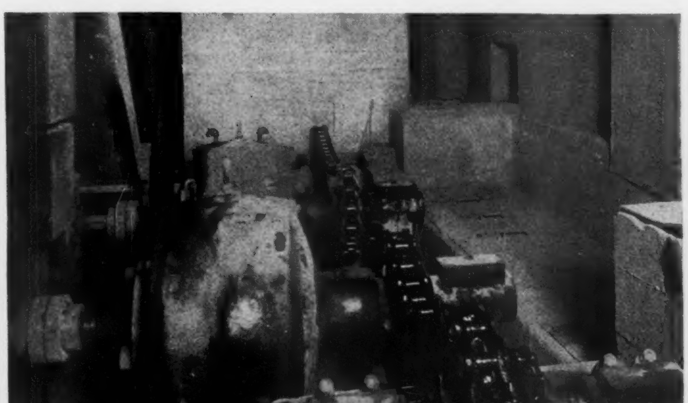
Poidometer serving finish grinding mill

The layout of the silos is somewhat different from the ordinary (see drawing) and the capacity is unusually large for a plant of this size. The silos were designed and constructed by the Macdonald Engineering Co., and have a capacity of 175,000 bbl.

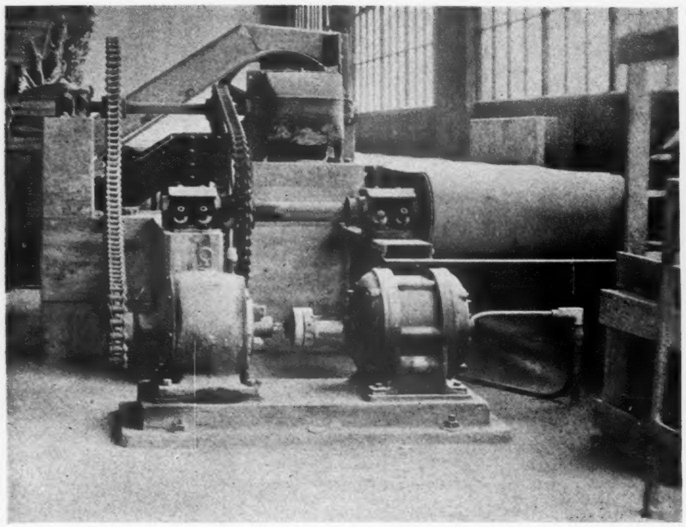
There are three screw conveyors under the silos, fed by F. L. Smidth Co.'s "Exbiners" mounted on cars and driven by four-speed motors. Each "Exbiner" has approximately the following capacities: 185, 370, 555 and 740 bbl. per hour. Each of the three conveyors is chain driven by a 50-hp. motor through a Foote speed reducer. (All reducers in the packhouse were furnished by Foote Bros. Gear and Machine Co.) The cross screw conveyors leading to the elevator are chain driven through gears and pinions by the main conveyors' motors. The elevator serving the bins above the packers



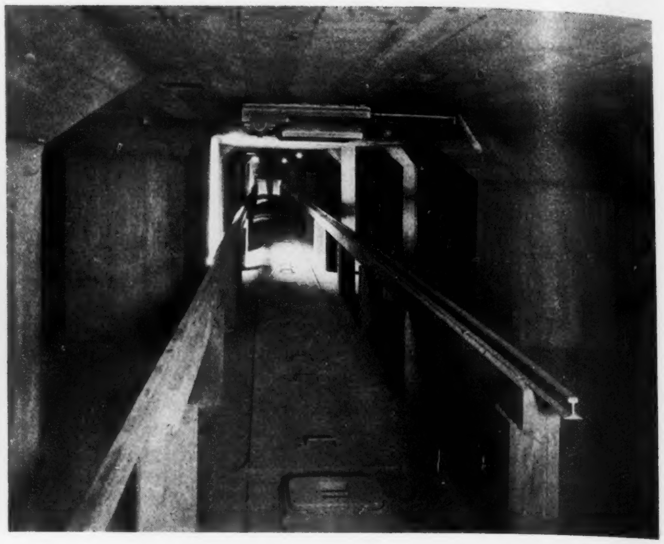
Main elevator and one of conveyors in pack house



Typical of the conveyor drives under the silos



Conveyor system for empty bags



Runway for "exbiners" under silos

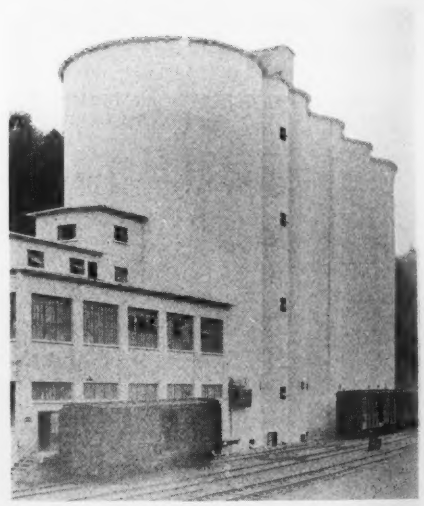
is built-in and an integral part of the building. It is driven by a 20-hp. motor through a speed reducer and has a capacity of over 800 bbl. per hour.

The packhouse is well arranged and has three floors. The top floor houses a W. W. Sly Manufacturing Co. dust arrester consisting of a No. 45 Claridge fan and 20-hp. motor, together with the necessary cabinets. Hoods are placed throughout the packhouse at all dusty points. On this floor is the screw conveyor from the main elevator to the packers' bins. It is driven by a 15-hp. motor through a speed reducer.

The second floor is devoted entirely to the storage, sorting and repairing of bags. (Bemis cloth bags and Bates multi-wall paper bags were stocked exclusively at the time of our visit.) Bags are handled between the first and second floor and on the second floor by two 30-in. belt conveyors both chain-driven by one 5-hp. motor through a speed reducer. At present no provision has been made for bag cleaning but it is planned to later install a cleaner of the short continuous type, with a capacity of 20,000 sacks per day. The cleaner will be located on the first floor.

Packing is done by two 4-valve Bates packers, but two more will be installed at a very early date. When the other two are put in, there will be two on either side, each pair back to back so that two machines will serve each loading track on either side of the building. As now arranged there is one machine for each loading track. Spillage from each pair of packers is removed by a small spiral conveyor chain-driven by a 5-hp. motor through a speed reducer.

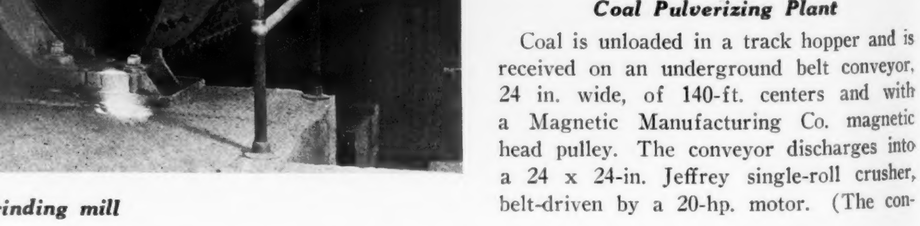
Finish grinding mill



Packhouse and silos

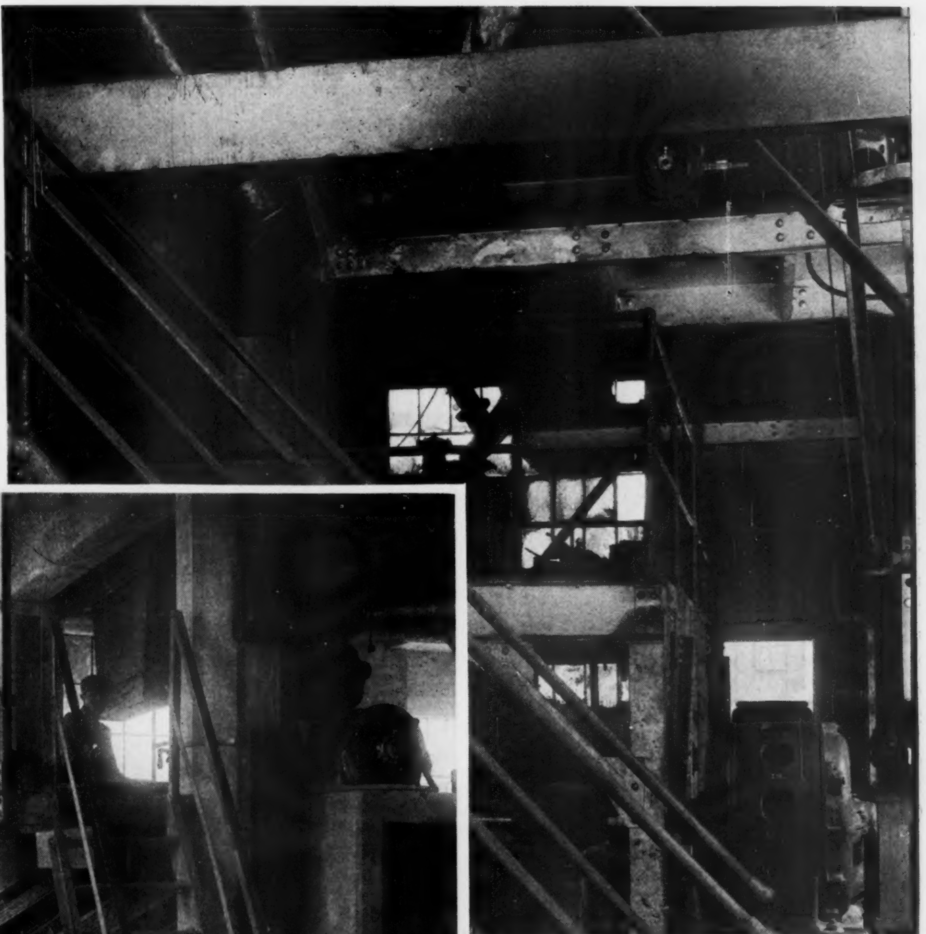
Coal Pulverizing Plant

Coal is unloaded in a track hopper and is received on an underground belt conveyor, 24 in. wide, of 140-ft. centers and with a Magnetic Manufacturing Co. magnetic head pulley. The conveyor discharges into a 24 x 24-in. Jeffrey single-roll crusher, belt-driven by a 20-hp. motor. (The con-



Arrangement of cement storage silos

veyor is chain-driven from the crusher's drive shaft.) The coal as it leaves the crusher is chuted into a 14x9x11¾-in. enclosed chain-bucket elevator of about 60-ft. centers, chain driven by a 15-hp. motor through a speed reducer. The elevator empties into a spiral conveyor (chain driven from the head-shaft of the elevator), which in turn discharges into two steel bins of 80 tons capacity each. Immediately under the bins are two Randolf dryers furnished by the Fuller Lehigh Co. Hot air for these dryers is pulled from the clinker discharge point of the kiln by two size 4 Sturtevant fans, each driven by a 25-hp. motor. Dust is removed from the hot gases, before going to the dryers, by a Clark separator. Proper temperature for the coal drying is maintained by a hand-operated valve in the kiln room near the pyrometer for each dryer. This temperature varies only from 125 to 150 deg. F.



Interior of coal pulverizing plant, showing bottom of dryers

The packhouse when finished will be equipped with four 4-valve packers and the usual belts for handling sacks

From each dryer the coal is fed by an automatic feeder (driven by a small Westinghouse motor through a Ganschow speed reducer) to two 46-in. Fuller Lehigh coal mills, each driven by a 100-hp. motor. These mills discharge into a spiral conveyor serving a Fuller-Kinyon conveying system which in turn supplies the steel coal-storage tanks above the kilns.

Machine Shop and Laboratory

The machine shop building is 40 ft. wide by 120 ft. long and is unusually well equipped. There is practically no job necessary at the plant that it cannot handle. Some of the major machines in the shop are: Five-ton standard Northern crane, which runs the full length and full width of the shop; combination punch and shear machine; power hack-saw; shaper; two emery wheels; 30-in. lathe; 15-in. lathe; 3½-ft. radial drill; 26-in. upright drill; bolt threader; pipe threader; 250-lb. power hammer and an electric forge. All the machines are direct driven.

The laboratory, in charge of A. E. Hiscox, chief chemist and superintendent, is well equipped for both chemical and physical tests. The test records (shown to the writer) were quite interesting and showed that uniformity of good quality cement can be attained and maintained.

Personnel

Officials and operating staff, other than Messrs. Binford and Hiscox, are: B. D. Phillips, president, of Butler, Penn.; F. C. McKee, vice-president of Pittsburgh, Penn. (Mr. McKee was former owner of the crushing plant and properties); and C. A. Wilder, secretary and treasurer, of Butler. Sales are being handled by Mr. McKee and C. R. Steenberg.

The company uses its name as a brand for sacks

Granite Quarry and Crushing Plant Operated by Unusual Methods

New Plant of Weston and Brooker, near Columbia, S. C., Represents Engineering Study and Experience Applied to the Solution of a Special Problem

THE operation of Weston & Brooker, at Cayce, a suburb of Columbia, S. C., is one of the most interesting in the United States, from the number of unusual features that have been worked into the design and the operating methods. The Westons (Mr. Brooker has retired from active participation in the business on account of ill health) are both trained engineers. T. I. Weston, president and treasurer of the company, is a civil engineer and W. S. Weston is a mechanical engineer. The latter is the inventor of the Weston crusher and some other machines not so well known; both have had a thorough training in plant design and operation.

Until last year the company operated a crushing plant that was built in 1907. This was largely of wood and it burned, as described in ROCK PRODUCTS, September 4, 1926. While the loss was somewhat severe from a financial standpoint, it gave the owners an opportunity to design a new plant and use the experience of almost 20 years in its design. All who have seen this plant admit that it embodies the best and latest ideas in the crushing, screening and washing of granite, a material which offers its own problems due to its toughness and its abrasive qualities, in addition to its great resistance to compression.

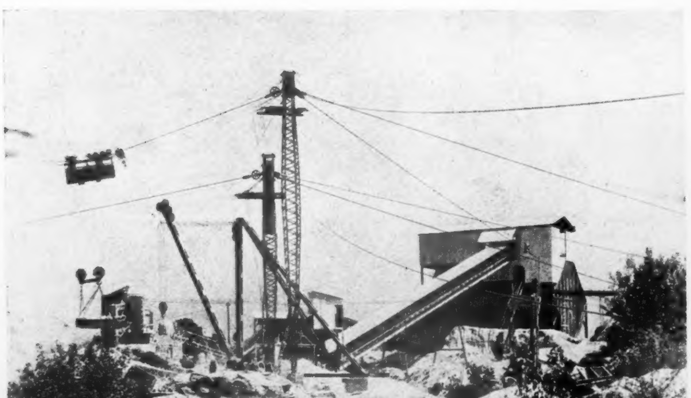
Quarry

The quarry is in the granite belt that is so important a source of aggregate and road

The quarry is worked in two 100-ft. benches. This shows the first bench

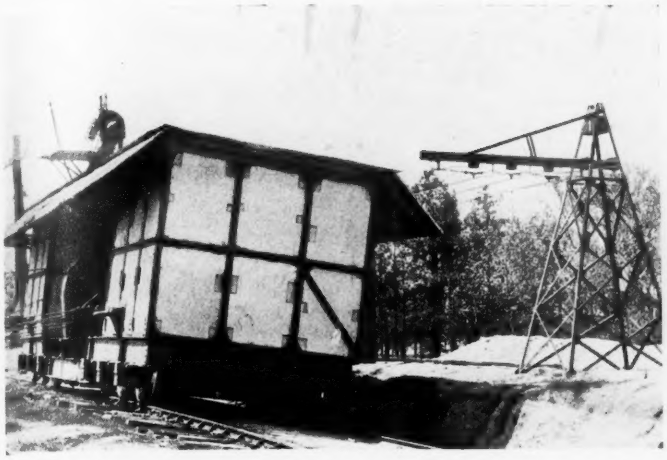
Looking at the crushing plant from across the quarry

material through Virginia and the Carolinas. As with almost all the quarries of this type, it is deep, the faces being 200 ft. high. This

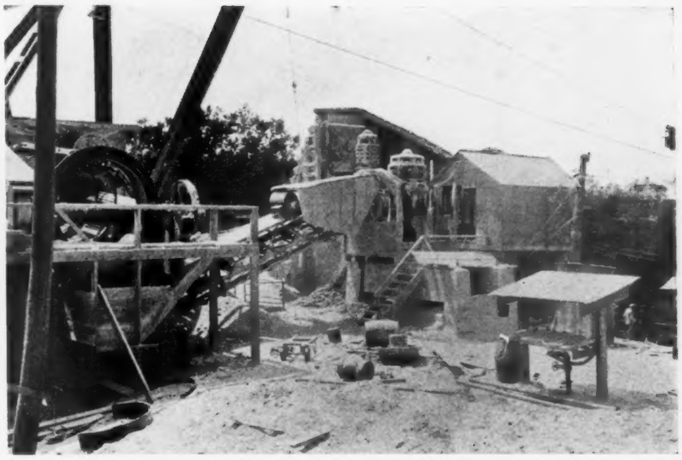


Cableway terminal and screening and washing plant shown in the rear

The two cableways showing the hoist house for the newer form at the extreme right



Hoist house for newer form of cableway



Secondary crushers and scalping screen

involves unusual conditions of drilling and blasting, and of transporting the material from the quarry to the crushing plant, and an interesting part of this story is the way these conditions have been met.

The quarry originally was two quarries which formed a V. They were thrown into one quarry by an interesting "big shot," which has been described in detail in ROCK PRODUCTS. This left the pit a rough fan shape. At the point where the sides meet the primary crusher stands, and it is to this point that all the material must be brought from whatever part of the quarry it originates.

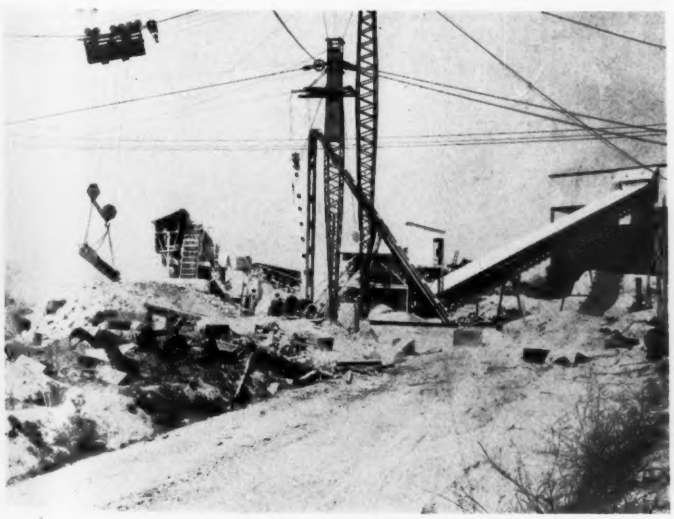
The ordinary way of working these deep quarries is by derricks set on the edge of the hole. The cableway is also used, but not to so great an extent; one reason for this is the expense of a cableway installation. But the Westons have used it, and not being satisfied with the standard types they have designed their own cableway, co-operating with the Lambert Hoisting Engine Co. in the design of a special hoist. This type is simpler and much easier on the cables than the standard types, and by its use they have reduced the cost of lifting the rock from the bottom of the quarry to the surface, and carrying it to the crusher. It now costs no more than the regular dinkey and car method employed in flat limestone quarries. The average cost with the present tonnage is only 10 cents per ton for all expense connected with the operation of the cableway.

Hoist house for older form of cabelway

The cost of breaking stone, however, cannot be reduced to any figure comparative to that of limestone crushing. The rock is tough as well as hard. The face is worked in two 100-ft. benches and 6-in. holes are put down by two Keystone well drills. Eight feet is a fair day's drilling. The holes are loaded with 75% gelatin in the bottom, and there must be at least 40 ft. of tamping above to make the rock break well. "Broken loads" of 60% gelatin are used in the upper part of the holes. The setting of the holes is 15 ft. apart with about 20 ft. burden and a lesser burden has been found to give no better fragmentation.

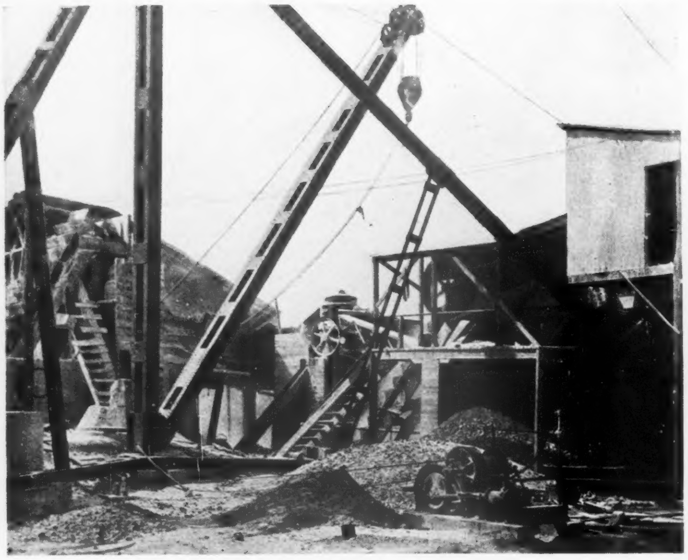
On account of the toughness of the rock, large pieces result from the big shots, no matter how the holes are loaded. This occasions considerable secondary blasting, estimated at 150 shots per day. They are fired when the men go off shift at noon and night. Ingersoll-Rand Jackhamers and 40% powder are used for this secondary shooting.

The broken rock is loaded by hand into the "pans" which are handled by the cableways. The pans are made of 9/16-in. flanged steel reinforced with 8x8x¾-in.

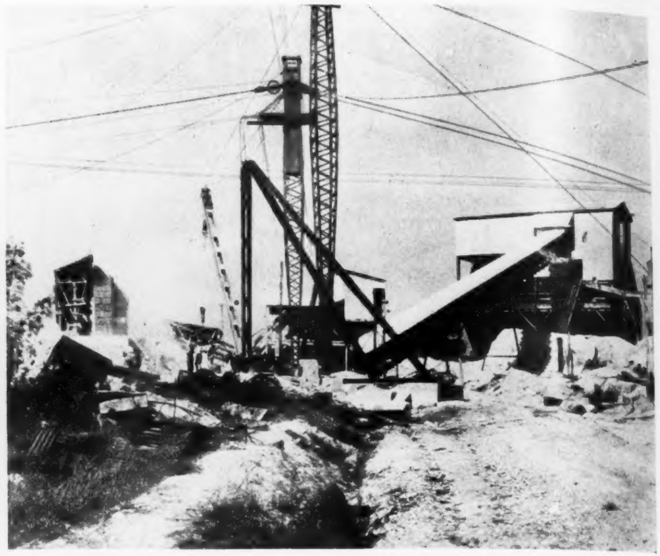


Pan in dumping position above primary crusher which is below ground level

Close-up of pan dumping



Derrick over crushing plant



Crushing plant and screening and washing plant

angles in the corners. They are 7 ft. wide, 10 ft. long and 2 ft. deep, except at the open ends, and while the capacity figures at 135 cu. ft., 5 tons is the usual weight loaded into them.

Cableway Transportation

Since the cableway is not so much used in quarries, a detailed description, especially of the new form, may be of interest. There are two cableways used, one being the standard Lambert machine used by contractors on levee work, and likewise on excavating that cover a considerable area. This has a tower mounted on trucks which moves on a double railroad track. Below the tower is the hoist house and back of it is a cribbing in which 190 tons of broken stone are placed to keep the tower from being pulled over into the quarry by the tension of the cables.

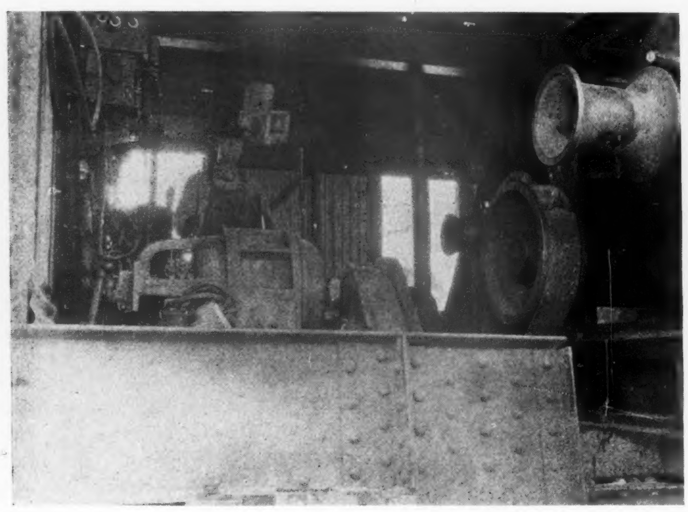
This form is all right, working on a flat piece of ground, but for quarry conditions the high tower is not needed. In the new form there is only a low house just high enough to contain the hoist and operator,

Masts of the two cableways

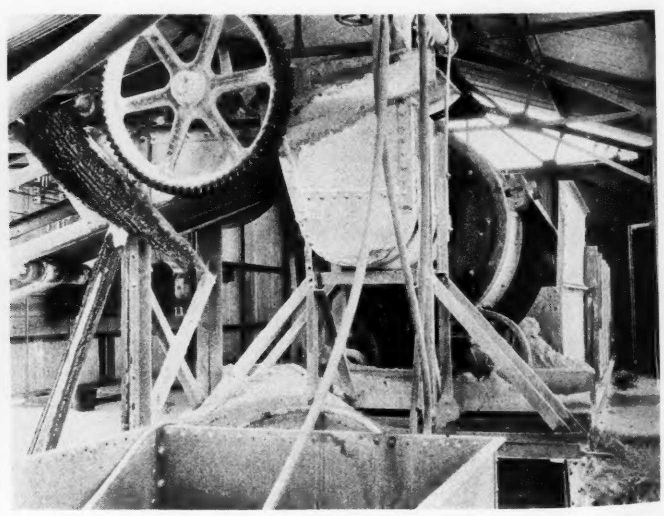
which runs on a track of 8-ft. gage, the outside rail being 18 in. lower than the inside. This angle is just enough to counteract the thrust and bring the pressure of the load normal to the bearings of the hoist.

Both machines use the same rope systems. The track cable is 2¼-in. in diameter and is pulled to about 5 deg. of deflection. A slacker rope than this wears more rapidly and a tighter rope is under too much tension. This cable is fastened to a bridle at the house and to a steel mast behind the primary crusher at the other end of the quarry, where a universal joint makes it possible for the cable to be swung in any direction without putting a side strain on the mast.

The carriage from which the pan is suspended runs on the track cable and it is moved back and forth by a ¾-in. conveying cable. This cable is connected to both ends of the carriage, and one end runs to a sheave on the tower and back to a drum on the hoist, while the other end goes directly back to the same drum. One end is fastened to the upper side, the other to the lower side of the drum, and on the opposite end, so that as one side is wound on the drum the other side unwinds. In this way the carriage is pulled back and forth with a

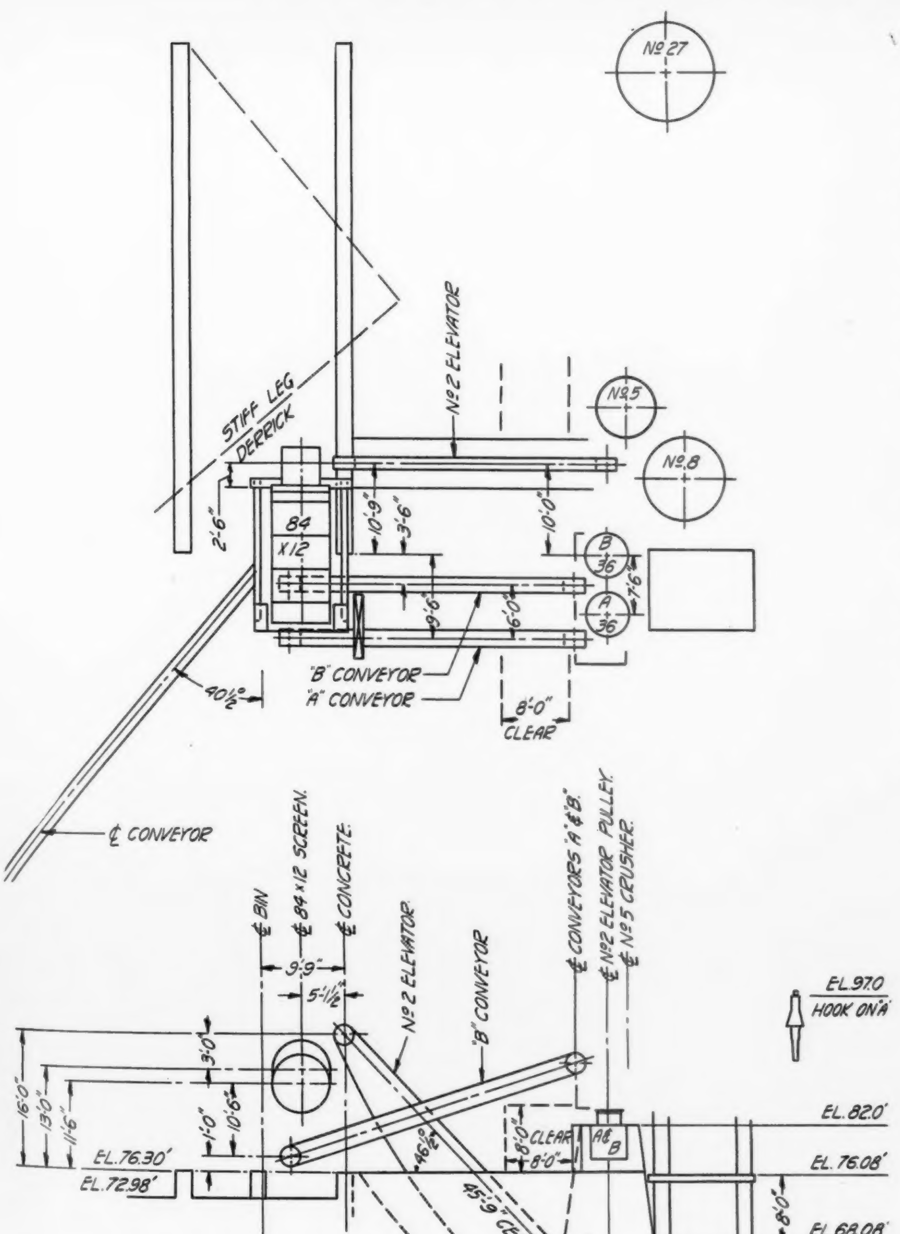


Hoist and motors for newer cableway



Conveyor head and rotary screws over bins

Right and left hand ends of the Weston vibrating washing screen



Plan (above) and elevation of crushing plant. Circles in the plan represent crushers

constant tension on the cables at all times.

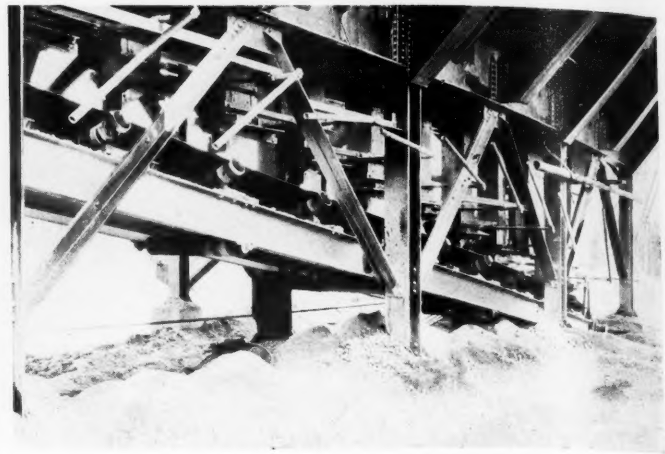
Beside the drum for the conveying cable there are two other drums, one for the loading cable and one for the dump cables, both being ¾-in. ropes. These drums are on the same shaft and move at the same speed, but either can be braked and held while the other is working. The load cable is fastened to the front end of the pan and the dump cable to the rear end. Together they lift the pan and hold it horizontally until it is above the crusher, when the dump cable drum is braked to hold it fast while the load cable drum is allowed to slip. This lets the front end of the pan drop and pours the contents of the pan into the crusher.

The time for a complete cycle, which includes unhooking the chains on the returned pan and hooking them on the full pan, transporting to the crusher, dumping the load, and returning, is between five and six minutes. A fair day's work (10 hr.) is 110 pans or 550 tons. This is sufficient for the present output of the plant, which is 1000 tons per day, or a little over. But this output is shortly to be increased to 1500 tons and the new hoist now being built and some minor changes in operating methods will make it possible for the two cableways to handle such a tonnage.

Hand loading is shortly to be displaced by shovel loading, and a 50B Bucyrus electric shovel has been purchased. It is expected that a second shovel will be installed later. One shovel and one cableway make a fair-sized unit when the cableway is working to capacity.

One of the heaviest expenses in connection with a cableway has been the wear on the track rope, which costs about $2 a foot. On the new form this wear has been found to be considerably less than on the old form, and the reason ascribed is that the loaded carriage is being pulled uphill. The pull of the conveying cable tends to lift the carriage from the track rope and considerably reduces the friction by doing so. The present track cable used on the new form has

Bins and screen house



Mixing conveyor under bins

given about three years of service already.

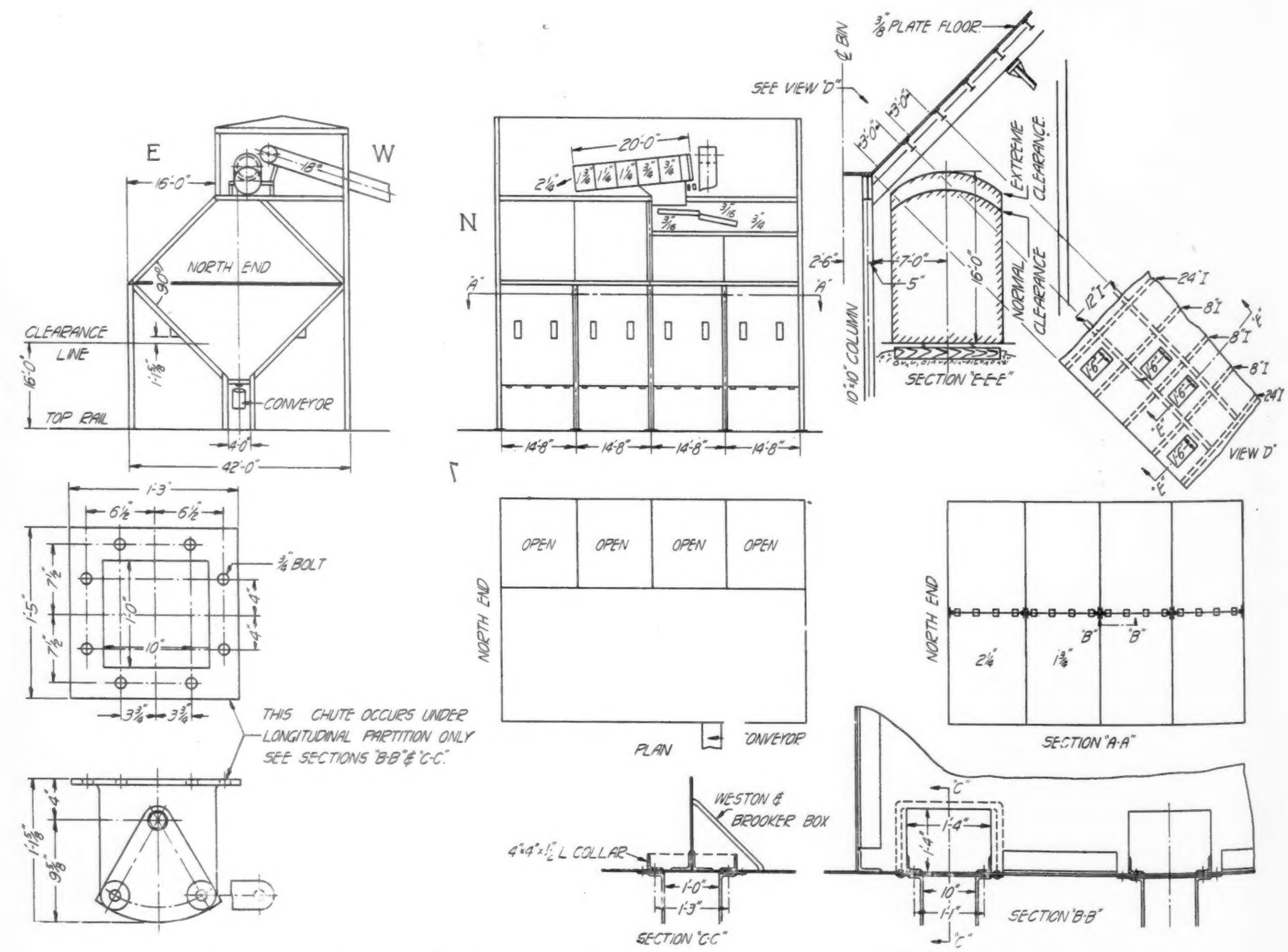
A 94-hp. motor is required on each drum of the hoist of the standard cableway and 75-hp. motors on the hoist drums of the newer form. Both machines are moved on the radial tracks by 20-hp. motors driving through worm gears. All motors are of General Electric make.

Crushing Plant

On reaching the plant the rock is dumped to a No. 27 Kennedy crusher which breaks it to pass a 6-in. ring. The discharge goes to a chain bucket elevator with manganese-steel chains working on plain wheels (not sprockets). Similar elevators are made as standard machines, but this particular one was made by the Taylor-Wharton Iron and Steel Co. from W. S. Weston's own designs. All parts are made of heavy manganese steel except the chrome-nickel steel pins in the chain.

This elevator discharges on a grizzly, or rather a gravity screen, made of a heavy plate punched with 2½-in. round holes. Every form of bar grizzly tried with this rock has choked. Even "fanning" the bars did not prevent choking.

The gravity screen oversize goes to a 36-A Weston gyratory crusher, which was the first machine of the kind ever built. It has a 7-in. opening at the top and a 2½-in. opening at the bottom. The crusher discharge



Plan, elevations and details of the bins and the screening and washing plant on the bins

goes to a second gravity screen with 2½-in. holes, and the undersize of both screens goes to a second elevator (No. 2) of the same type as the No. 1 elevator previously described, except that the buckets on No. 2 elevator are only 30 in. wide. Both have 45-ft. centers. The oversize of the gravity screen goes to a No. 8 Kennedy crusher and back to the No. 2 elevator.

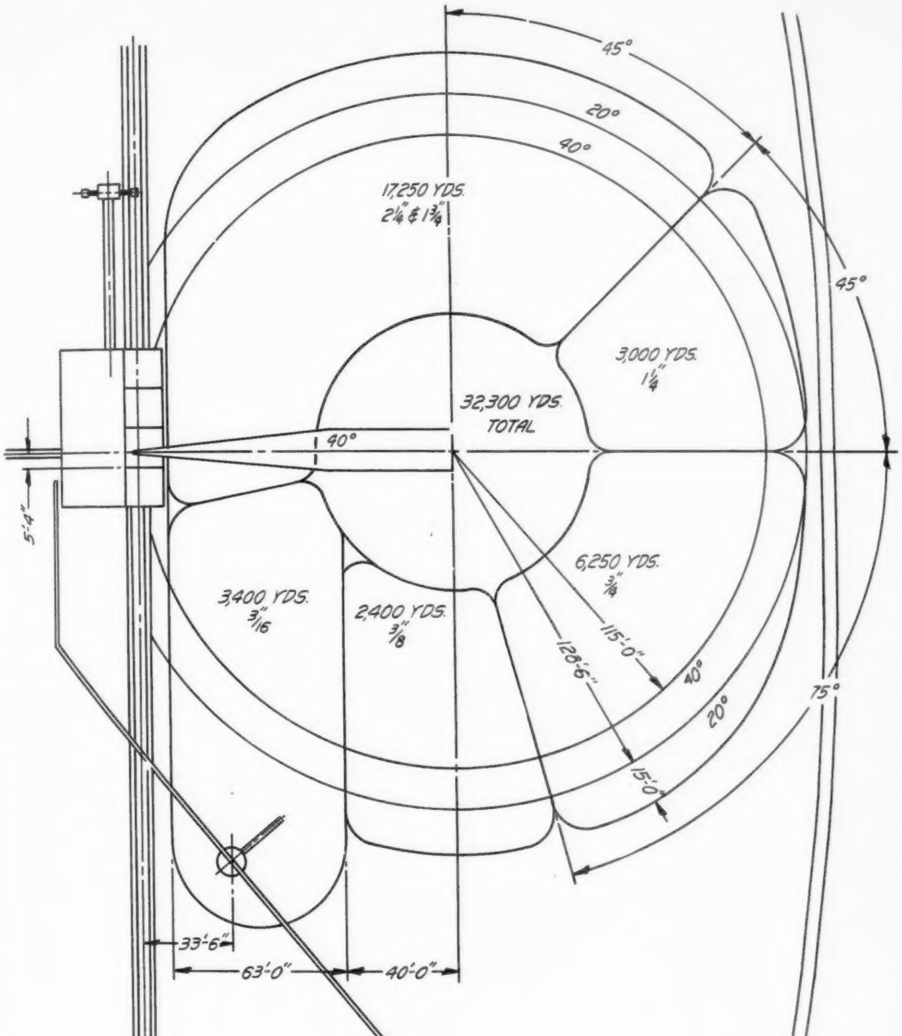
This No. 2 elevator discharges into a Traylor revolving cylindrical screen 84 in. diameter and 12 ft. long, with 2⅜-in. round hole perforations. The oversize of this screen goes to a No. 36-B Weston gyratory crusher and into the boot of the No. 2 elevator to be returned to the scalping screen.

The No. 36-A Weston crusher and the No. 8 Kennedy crusher are to be changed shortly, in order that each may do the class of work for which it is best adapted, the Weston being strictly a finishing crusher.

In this way everything is reduced in the crushing plant to pass the 2⅜-in. holes of the scalping screen. All the product then goes to the main conveyor of the plant, which is 24 in. wide and 176-ft. centers.

Bins and car loading device

Mr. Weston believes it important to have a conveyor very carefully built and supported, and the structure that holds this was designed for them by T. C. Gideon, a local construction engineer. The conveyor was made by the Robins Conveying Belt Co. Timken bearings were specified for the troughing idlers and Hyatt bearings for the return idlers. In spite of the exceedingly hard service to which it is put, the belt shows hardly a sign of wear and is expected to last a long time.



Plan (above) and elevation of the storage system, showing how material is handled in and out by the derrick

Screening and Washing

This conveyor discharges to an Austin screen (on the upper floor of the building above the bins) which is of 60-in. diameter and 20-ft. length. It has 7/16-in., ¾-in., 1¼-in. and 1¾-in. round-hole perforations. Each product of this screen, except the undersize, goes to a bin. Water is added at this screen from a Worthington pump that throws 800 g.p.m., so that the stone is thoroughly washed as well as sized. The through products of the 7/16-in. holes and the ¾-in. holes go into a chute and run to the Weston vibrator screens, which are on the floor below.

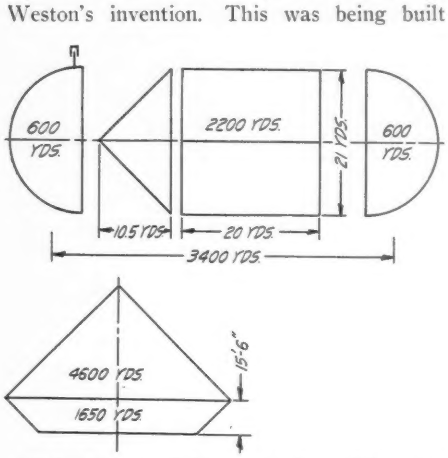
There are two of these in series and the first is an under-water screen, one of the few successful devices of the kind that have been made. The screen is rapidly vibrated lengthwise by an unbalanced pulley and spring suspensions, the "throw" being adjusted by the placing of weights in a hollow pulley. There is a pan, enclosing the screen, with holes for the water to pass through, and these holes are adjusted so that the screen is always covered with water, although the water continually flows through the screen, taking the fines with it. The advantage is not only good screening but an unusual freedom from blinding. The second vibrator is like the first except that the screen is not under water; in fact it is made to dewater the oversize as much as possible.

The screen on the first vibrator is usually one with ⅝-in. holes and the screen on the second vibrator is usually one with 7/32-in.

holes. But these screens may be changed when special, fine sizes are needed.

Sand Recovery

The undersize of the 7/32-in. holes is called "sand" and passes with the water to an automatic sand settling device of W. S. Weston's invention. This was being built



Calculation of bin capacity with end storage

when the plant was visited, so it was not in place.

Unusual Bins

The steel bins are of an unusual shape, the ends being squares with a corner pointing downward. The width and height are both 40 ft. (on the diagonals of the square). There is a longitudinal partition and four cross partitions, making eight bins, each of which has an outlet to a conveyor belt below. This belt runs first straight and then on an incline to a carloading point. The greater part of the output of this plant is sold in mixed sizes, the mixtures being prescriptions received from highway engineers and others, and the mixing is done on this belt. The chutes from the bins have gates which may be opened just enough to admit the right amount of each size, and experience has shown the men how to hold closely to the specified percentages of the different sizes. The mixing and spreading arrangement at the discharge end of this conveyor is described in the "Hints and Helps" section of this issue.

Ground Storage

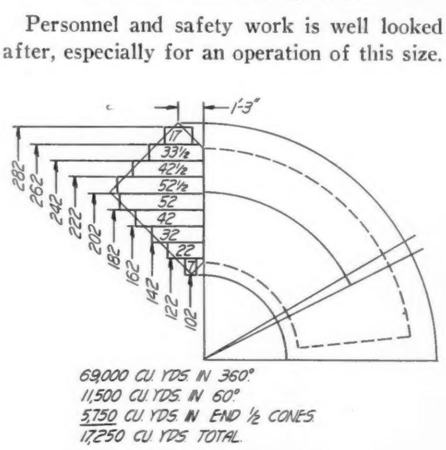
In connection with the bins a storage system is being installed that is different from the systems usually found in stone plants. The bins were built with this in view, and the top of the bins is large enough so that a clamshell bucket can be lowered into them by a derrick. In this way storage can be placed in piles, one for each size, around the derrick. For recovery the derrick takes the material from the pile and puts its back in the bin from which it came, so that it can flow out on the belt if it is to go in a mixture of sizes. If it is to be loaded as a single size it can be placed directly in a car. A diagram with this shows how the storage is handled.

Everything about the plant is electrically driven, the motors used being of General Electric make, with one or two exceptions. The No. 27 Kennedy and the No. 8 Kennedy are driven by one motor of 175 hp. of the slip-ring induction type. The No. 36-A and No. 36-B Westons have each a 75-hp. motor (mounted vertically on the upper part of the shaft), which is of special design, to run 400 r.p.m. No. 1 and No. 2 elevators have each a 30-hp. motor and the main conveyor has a 20-hp. motor. Each screen, scalper and sizer has a 20-hp. motor. For pumping, a 40-hp. motor drives a 5-in. two-stage Worthington centrifugal pump in the quarry, which takes care of the small amount of seepage and surface water encountered in the work. The 5-in. Worthington which furnishes the wash water is driven by a 35-hp. motor.

For operating the Ingersoll-Rand jackhamers used in blockholing, there is a 1250-cu. ft. Worthington compressor, driven by a 250-hp. Ideal synchronous motor. A 40-hp. motor of the same make is used on the "home-made" car-puller.

Personnel and Safety Work

Personnel and safety work is well looked after, especially for an operation of this size.



Calculation of storage capacity

It is in charge of W. L. Blackwell. Naturally, in an operation of this kind there is always danger, but the men are carefully trained to think of safety, and the results of such training have been excellent. No hospital case or fatality had occurred in the 8 months previous to the time the plant was visited.

A. K. Rucker is in charge of the quarry and W. F. Hathcock is the mechanic who not only keeps the plant in running condition, but the man who puts many of W. S. Weston's ideas into actual operation.

The office of the company is at Cayce.

"Relation of Aggregates to Concrete"

BULLETIN 2 of the National Sand and Gravel Association has the title, "Relation of Aggregates to Concrete," and it is a well written pamphlet of 24 pages covering the main facts about aggregate and concrete

W. I. Weston (left) and T. S. Weston at right

which an engineer should know to use them intelligently. According to the preface, much of the subject matter of this bulletin has been already published as a series of articles in the *Improvement Bulletin* of Minneapolis, Minn. It is a good thing to have this series collected and also edited and added to for collective publication.

Stanton Walker, the author, who is director of the engineering and research division of the association, points out what is too often forgotten, that aggregates have qualities that are the really vital factor in the quality of the concrete made from them. He then discusses briefly the theory of concrete strength, and goes on to explain what is the real dollars and cents value of well-graded aggregate. Producers would do well to study this section very thoroughly. Under "The Importance of Uniform Aggregates" is another discussion that will interest producers, as it contains the reasons why established producers can provide aggregates that cannot be approached in quality by pit- and channel-run aggregates used without proper preparation. There is a very good chapter on the effect of clay and loam, with statements of the deleterious effects of these from many authorities.

The latter part of the bulletin is given to the designing of concrete mixes and the method devised by Mr. Walker for estimating qualities of materials which has already been published in ROCK PRODUCTS.

The bulletin illustrates perfectly how far we have come from the old days when the selling of a basic material was to be accomplished by much bold-face type which shouted loudly of "quality" with no explanation of what quality meant. The present bulletin contains nothing but sound, sane and scientific reasons, economic as well as engineering, why well-prepared aggregates must be used in making concrete, if the concrete is to be strong and enduring.

Copies of this bulletin may be obtained from the Washington office of the National Sand and Gravel Association.

Rock Products at the Annual Meeting of the American Society for Testing Materials

Committee Activities in Cement, Lime, Gypsum and Concrete Aggregates—Two Papers on Portland Cement

THE thirtieth annual meeting of the American Society for Testing Materials, held at French Lick, Ind., June 20-24, again emphasized the increasing demand for constantly higher quality cement and concrete aggregates. And all the discussion on quality of concrete was not confined to the subject of aggregates. The actual cementing value of the cement used is coming more and more to be considered and discussed.

Sand-Lime Brick

The committee on brick in co-operation with the committee on nomenclature succeeded in having the following definition of *brick* adopted:

"*Brick.*—A structural unit formed while plastic into a rectangular prism, usually solid and 8 by 3¾ by 2¼ in. in size.

"*Note.*—The term 'brick' is understood to mean a unit of burned clay or shale. When other substances are used, such as lime and sand, cement and sand, fire, clay, adobe, etc., the term 'brick' should be suitably qualified."

Sand-lime and concrete brick manufacturers succeeded only in having the definition "if it isn't clay it isn't brick" put in the form of a footnote rather than in the definition proper.

Lime

Members of the sub-committee on chemical lime have been taking active part in research work to correlate physical properties of lime with the manner in which it functions in various processes with a view to determining the desirability of including these properties, such as bulking, rate of settling, etc., in specifications. Through co-operation with the Lime Section of the Bureau of Standards and the Interdepartmental Conference on Chemical Lime complete analyses of some 36 commercial limes have been published and are now available for consideration in preparation of specifications for lime for use in chemical industries.

The sub-committee on method of testing lime is continuing investigations to determine standard methods for measuring:

1. Sand carrying capacity of lime mortars;

2. Bulking properties of hydrated lime;

3. Rate of settling of milk of lime suspensions, and correlation of such data with industrial operations;

4. Fineness of particles of hydrated lime smaller than can be measured with a sieve;

5. Absorption of base plates for plasticimeter; and also

6. The quantity of free lime in hydrated lime.

The committee offered a tentative specification for sand for use in lime plaster and lime stucco, in which the following grading is proposed:

Retained on:	
No. 8 (2380-micron) sieve..	not more than 10%
No. 30 (590-micron) sieve..	not more than 80% not less than 15%
No. 50 (297-micron sieve)..	not more than 70% not less than 20%
No. 100 (149-micron) sieve..	not less than 95%
Weight removed by decantation	not more than 5%

Brick Mortars

The paper by L. E. Weymouth, of the Celite Co., Lompoc, Calif., on "Improved Brick Mortars," deals with increasing the plasticity of cement mortars by the additions of varying proportions of hydrated lime and diatomaceous silica. In a series of tests the mortars were grouped as follows: (1) Straight hydrated lime-cement-sand mortars met with in actual practice; (2) groups in which 25%, 50% and 75% of the hydrated lime was replaced with pulverulent diatomaceous silica.

The most striking results obtained from this series of tests were the large increases in strength obtainable by the use of the diatomaceous silica. Adding diatomaceous silica to a lime-cement mortar (not replacing part of the lime by silica) greatly increases the strength of the mortar, with a greater relative increase in strength in the weaker mixes, containing smaller proportions of cement than the 1:6 cement-sand ratio group.

It is believed that the increased strengths obtained with diatomaceous silica are caused by a chemical combination between the hydrated lime, including that formed by the hydrolysis of the cement, and the diatomaceous or amorphous silica. The results show that reduction in the proportion of hydrated lime cannot account for the increased strengths obtained, nor can they be ascribed to a reduction in the water content, as the water content is somewhat increased as the hydrated lime is replaced by diatomaceous silica. The reaction between hydrated lime and silica at higher temperatures is well known and is made use of industrially in the manufacture of sand-lime brick. This reaction, which forms monocalcium silicate, has been studied by a number of investigators. The reaction at room temperature takes place much more slowly, but definite evidence of chemical combination has been observed. Le Chatelier has prepared and studied the hydrated calcium silicate obtained by adding an excess of lime-water to a colloidal solution of silicic acid. He considers the compound formed to have the composition of $2CaSiO_3 \cdot 5H_2O$.

It is concluded from these tests that the addition of diatomaceous silica to a mortar increases its plasticity as well as its strength. The proportional replacement of lime with diatomaceous silica, according to the plan followed, gives mixes of practically equal plasticity and cost, but with greatly increased strengths.

Gypsum

Present tentative standards for testing gypsum and gypsum products were advanced to standard. Some slight modifications were made in other features of the tentative and standard specifications. In the committee meeting an adequate definition for Keene's cement received considerable attention.

Cement

The most interesting feature of the committee report on cement was a progress summary of a current investigation being carried on for the purpose of (1) comparing strength tests on fluid cement-water mixes, standard sand cylinders and briquets made by different laboratories using the same cement, (2) studying the day-to-day uniformity of strength tests, (3) studying the effect of varying quantities of mixing water in cement-water mixtures, (4) studying the flow cylinder test for consistency of fluid cement-water mixtures, and (5) studying the possibility of a one- or three-day strength test for portland cement.

The returns of the 52 co-operating laboratories to date were incomplete. Three- and seven-day compression tests of neat cement cubes or cylinders were slightly more consistent than tension tests of either neat cement briquets or 1:3 standard sand briquets. On 28-day tests all showed about the same average mean variation. The weighted average mean variation in all test results was around 4%.

The conclusions up to this time are: The use of a fluid cement mix containing about 41% of water by weight of cement seems to be most suitable for a compression test. The fluid neat cement mixture presents the possibility of a 3-day test with fairly uniform results.

High Magnesia Cements

The paper by P. H. Bates, of the U. S.

Bureau of Standards on "Long Time Tests of High-Magnesia Portland Cements," gave results and conclusions in regard to cements made about twelve years ago by the Bureau at its experimental cement plant. The manufacture and composition of these cements has been described in the U. S. Bureau of Standards *Technologic Paper 102,* published in 1918. Mr. Bates' conclusions are:

Certain of the conclusions appearing in the *Technologic Paper* which would interest those concerned with the physical qualities of cement rather than with the chemical characteristics are presented below. While these conclusions were based upon the deportment of the cements at the end of 1½ years, the results obtained at 10 years do not justify any changes. It should be borne in mind that the question of the magnesia content of cement is a large and intricate one and was not completely covered in this investigation. Thus it can be readily appreciated that the difference in the molecular weights of lime and magnesia would have required changes in the amount of the acidic components of the raw materials as the ratio of lime and magnesia was changed. This was not done in this investigation. The procedure followed was that more commonly used in commercial practice, namely, holding the ratio of total basic to acidic components constant.

1. "Portland cement with a magnesia content of about 9.50% may be burned in a rotary kiln without producing a clinker materially different from one containing less than 4%. The clinkering temperature will be reduced somewhat, however. With greater amounts of magnesia present the resulting clinker is very vitreous and dusts more or less slowly, the rapidity and amount of dusting increasing with the magnesia content. High-magnesia clinker is of a light-brown color, in strong contrast to the usual dark, glistening, normal clinker. The resulting ground cement is of a light-brown color, which makes a concrete decidedly different in color from concrete made from normal cement."

2. "The strengths developed, either by the neat cement or 1:3 sand mortar or 1:1½:4½ gravel concrete, show that cements containing as much as 7.5% of magnesia are satisfactory. It would be impossible to predict from the strength tests at the end of 1½ years which were the cements containing low magnesia or magnesia up to 7.5%. With higher amounts the strengths developed decreased with increased magnesia, but even with the high-magnesia cements there is a notable increase of strength with age."

3. "The strength of the concretes subjected to the action of the solution of salts was not materially different from that of those subjected to the action of water. While some of the specimens did show a slight disintegration, it was not sufficient to affect their strength at the last period at which they were tested, and, furthermore, it appeared in the case of concrete made from cements of moderate magnesia content and was not noted in those of high-magnesia content."

4. "The high-magnesia cements contain a large amount of 'insoluble residue.'* This residue is the monticellite and spinel, both of which are very largely insoluble in dilute acids."

"Attention should again be called to the fact that the work presented in this paper was not undertaken to show the advisability of allowing a greater magnesia content in cement, but only to determine how greater amounts of magnesia affect the constitution and properties of cement of normal composition."

In the above quoted conclusions from the *Technologic Paper,* it should be noted that it is stated that a magnesia content of 7.5% would not be too high to permit of a cement having satisfactory qualities. However, the recent modification of the Society's standards for portland cement would indicate that 6.5% would be the maximum if these strength requirements are to be met as indicated elsewhere in the text.

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1. **Report of Committee C-7: On Lime. H. C. Berry, Chairman.**
   Presents new specifications for lime plaster. Recommends the advancement to standard of specifications for quicklime for use in the manufacture of sulphite pulp, for hydrated lime for the manufacture of varnish, for quicklime for use in water treatment and for hydrated lime for use in water treatment. Submits revisions of the methods for chemical analysis of limestone, quicklime and hydrated lime.
2. **Improved Brick Mortars. L. E. Weymouth.**
   Presents the results of a series of tests on sixty different brick mortars, ranging from very plastic to very lean mixes. Three cement-sand ratios were used and varying proportions of hydrated lime and diatomaceous silica. Results bring out some interesting relations between the plasticity, strength, and composition of mortar mixes.
3. **Report of Committee C-11: On Gypsum. J. W. Ginder, Chairman.**
   Recommends the advancement to standard of the tentative revisions of the specifications for gypsum plaster, gypsum partition or wall tile and of the methods of testing gypsum, the latter revisions being slightly amended. Submits new definitions of terms relating to gypsum plasters.
4. **Report of Committee C-1: On Cement. P. H. Bates, Chairman.**
   Reports on an extensive investigation being carried out to determine if the use of a neat cement test made by mixing the cement with a high percentage of water will indicate better than do specimens of normal consistency the value of a cement in concrete.
5. **Long-Time Tests of High-Magnesia Portland Cements. P. H. Bates.**
   Presents the results on 10-year specimens of an investigation carried out a number of years ago by the U. S. Bureau of Standards covering the making and testing of high-magnesia portland cement, some cement having a magnesia content as high as 25%.
6. **The Tensile Strength of Portland Cement Constituents. Jasper O. Draffin.**
   Shows the strength-time relation of the three principal constituents of portland cement, tri-calcium aluminate, tri-calcium silicate and di-calcium silicate, in both neat cement and 1:3 sand mortar. Suggests a different angle from which the strength of cement may be viewed.
7. **The Use of Lumnite Cement in Short-Time Tests to Determine the Quality of Fine Aggregate for Concrete. Sanford E. Thompson and M. N. Clair.**
   Information in regard to the quality of a doubtful sand is often required within 24 hours. The test described is intended to furnish the information. The authors conclude that the test is valuable as a preliminary indication, but that the portland cement test at the later periods should be made as a check.
8. **Report of Committee C-9: On Concrete and Concrete Aggregates. Cloyd M. Chapman, Chairman.**
   Submits new methods for approximate specific gravity of fine aggregates, field determination of surface moisture and of approximate percentage of voids. Discusses the soundness of aggregates. Presents a review of theories of designing concrete, supplemented by the following paper:
   A Study of the Data of "Series 201" and Wisconsin Tests Showing the Relation of the Compressive Strength of Concrete to the Water-Cement Ratio, Space-Cement Ratio and Grading of the Aggregate. R. A. Nelson.
   The following paper is also included:
   Geological Aspects of Concrete Aggregates. G. F. Loughlin.

Portland Cement Constituents

The paper of Prof. Jasper O. Draffin, University of Illinois, illustrated how data on the composition of portland cement, and cement test results, already old, may be re-analyzed and treated from different angles. His introductory paragraphs explain the objective and the source of his experimental data as follows:

"The strength of portland cement cannot be measured by the extent to which a single property or quality is present; the tensile strength, compressive strength, resistance to abrasion, adhesion to aggregate, resistance to solution by water, permeability and durability are all properties of importance in the varied uses of cement, and information concerning each of these properties is essential to a complete knowledge of the material. Nevertheless, it is usually necessary to study each property separately and then attempt to evaluate the material on the basis of part or all, as the case may be, of the factors. This paper presents the results of a study of the tensile strength of portland cement using as basic information a series of tests made at the U. S. Bureau of Standards. In these tests the more important compounds in portland cement were prepared from pure materials and mixed with each other in definite proportions. These mixtures were then made into neat cement and sand-mortar briquets and tested in tension. The results of these tests are analyzed and presented."

"It is fairly well agreed that the principal constituents in portland cement are tri-calcium aluminate ($3CaO{\cdot}Al_2O_3$), tri-calcium silicate ($3CaO{\cdot}SiO_2$), and beta di-calcium silicate ($\beta\,2CaO{\cdot}SiO_2$). It is also generally supposed that the 24-hour strength of cement is due chiefly to the tri-calcium alumi-

*A. S. T. M. Standard Specifications and Tests for Portland Cement (C-9-26), A. S. T. M. Standards adopted in 1926.

nate; the 30-day strength to the tri-calcium aluminate and the tri-calcium silicate, and the increase in strength after this period to the di-calcium silicate.

PERCENTAGES OF THE THREE CONSTITUENTS OF PORTLAND CEMENT WHICH WERE PREPARED, MIXED TOGETHER, AND GROUND

Tri-Calcium Aluminate	Tri-Calcium Silicate	Di-Calcium Silicate
100	......	......
......	100	......
......	......	100
19	81	......
19	......	81
......	50	50
19	40.5	40.5

"The strength-contributing value of each constituent has been determined by first considering the strength of the briquets made of pure tri-calcium aluminate, tri-calcium silicate, and di-calcium silicate, which gave the strength of each constituent in a pure state. The strength of any mixture of these constituents might be expected to be the sum of the strengths of the separate constituents. This composite strength was, however, modified by the restraining or accelerating action of each constituent in the mixture on the others present, so that the strength of the mixture was always greater than the sum of the strengths contributed by each compound. This increase in strength was apportioned among the constituents in proportion to the amount which each was first assumed to contribute to the strength of the mixture. By computing the strength of the various mixtures separately and by taking averages of all the combinations tested, the values were determined in terms of the tensile strength, in pounds per square inch, contributed by each 1% of the constituent. Stated differently, the results show the unit strength which each 1% of constituent contributes to the strength of the mixture."

In conclusion, Prof. Draffin stated: "This paper is not intended to present a method which may be used at the present time, under all conditions, to estimate the strength of portland cement from its chemical composition, but rather to call attention to the possibility of a fairly close relationship between the two. It is another point of view from which the strength may be considered, similar in its essentials to that used by Campbell and by Sauveur for the estimation of the strength of steel in which the percentages of carbon, phosphorus and manganese are known."

Lumnite Cement Briquets for Testing Sand

The conclusions of the authors, Sanford E. Thomson and Miles N. Clair, of the Thomson and Lichtner Co., Inc., Boston, Mass., are: "The Lumnite-cement 24-hour mortar test for determining the quality of fine aggregate for concrete, made in accordance with the method described in this paper, gives results comparable with those obtained by the portland cement mortar test at 28 days. We consider it of value where information must be obtained concerning the qualities of fine aggregate within 24 hours and which is to be checked by portland cement tests later."

Concrete Aggregates

One of the high points in the discussions of the committee on concrete and aggregates was an informal talk by G. F. Loughlin, of the U. S. Geological Survey, on unsound limestone aggregates. Mr. Loughlin illustrated his talk with actual samples of crushed stone. It seems that there are numerous argillaceous limestones which will pass every physical test in regard to compressive strength, hardness, coefficient of wear, etc., and yet go to pieces within a few years when incorporated in concrete, or when exposed to weathering in the quarry. At least one large quarry operation in Pennsylvania has had to be abandoned because the stone was unsound.

The sodium sulphate test will show up the unsoundness of such limestones. The trouble with the sodium sulphate test, however, is that some good stone, such as a good dolomite, will also be disintegrated by it, but for a different reason. The argillaceous limestone will disintegrate because of a clay-forming mineral known as beidellite, which exists also in shale. This mineral has the power to take up water and swell, so that mere wetting and drying is sufficient to destroy rock containing it. The argillaceous limestone will also disintegrate when the argillaceous or clay impurities are deposited in it, in the form of sheets or films, as is frequently the case. A good dolomite, which will stand weathering and makes a satisfactory concrete aggregate, will disintegrate under the sodium sulphate test because of its porosity. Hence the sodium sulphate test in itself is not a safe guide to the quality of a crushed-stone aggregate.

Mr. Loughlin said any argillaceous limestone should be used with caution. A chemical test (dissolving the sample in hydrochloric acid) should always be made and the amount and character of the insoluble residue determined. If examined by a petrographer the presence of beidellite can be readily determined, and the stone should not be used. If, however, the argillaceous material is thoroughly distributed in the rock, and does not occur in films or planes, or in the beidellite form, it may be safe to use the stone for aggregate.

Specifications and Tests of Aggregates

Sub-Committee V of the committee on concrete and concrete aggregates studied the soundness of aggregates, their abrasion and weights of materials during the year. In the report on the soundness (sodium sulphate) test, this committee says:

"The main difficulty with the test is in the interpretation of the results in terms of resistance of the particles to the action of the weather. The general opinion of the results obtained is that they are of negative value. That is, stones passing the test appear to be satisfactory, but those which fail in the test must be further examined to determine their durability. Usually this is done by examination of exposed faces of deposit when these are available, or by extended freezing and thawing tests.

"Several laboratories are already attempting to determine the relation between the sodium sulphate test and freezing and thawing. Not all of these have furnished useful information, but the data collected indicate that the sodium sulphate soundness test is somewhat erratic in its results. In many cases stone deposits which have long been used as a source of aggregate for concrete with apparent satisfaction have shown considerable disintegration in this test, while at the same time they have shown very little disintegration in freezing and thawing. Likewise, stones which have shown considerable disintegration in the sodium sulphate soundness test have shown no reduction in the compressive strength when concrete made with these aggregates was subjected to 90 alternations of freezing and thawing. Also, no disintegration was apparent when concrete made with these aggregates which showed unsoundness was subjected to 25 alternations of freezing and thawing."

The committee also finds that sodium sulphate is purchasable in three forms and that the form used, as well as the temperature, will affect the concentration of the solution. Chemical action is claimed by one investigator to affect some rocks. The committee concludes that this test should be investigated along the following lines:

1. To determine whether or not there is chemical reaction within the test piece.

2. To determine the effect of recrystallization of the salt within the specimens to other forms. This could be accomplished by soaking the samples in fresh water for 20 hours after the second and fifth drying periods and noting the effect.

3. To devise suitable quantitative measurement of the result of the test. This could be accomplished by one of the ways which have already been tried, probably best by the determination of fineness modulus of a 3000- or 5000-g. sample.

4. To determine the relation of the test to actual freezing and thawing, possibly by the relative effect of the two tests on some other physical property such as compressive strength, toughness, hardness, or abrasion.

The data from extensive investigations now under way in the U. S. Bureau of Public Roads and several state highway departments should, when available, afford information which will permit of definite recommendations by this committee.

Reports on abrasion and weight of materials were deferred for further study of the large amount of data which has been collected.

Determination of Voids, Specific Gravity and Moisture Content of Aggregates

The methods offered by Cloyd M. Chapman for determining percentage of voids in fine aggregate when inundated, approximate

specific gravity of fine aggregate and percentage of surface moisture in fine aggregate were recommended by the same sub-committee to be accepted as tentative standards. All three methods use a flask of special shape devised by Mr. Chapman, and now obtainable from several makers, and an ordinary pan balance.

Relation of Quality of Aggregates to Quality of Concrete

Sub-Committee X of the concrete committee has given much study to causes of disintegration of concrete and finds them to be:

1. Excess of mixing water;
2. Deficiency of cement;
3. Dirt or an excess of fine material in the aggregate;
4. Segregation of materials in handling and placing the freshly mixed concrete.

The reason why all these tend to disintegrate concrete is because they add to the permeability of concrete. The quality of the aggregate used is closely related to the permeability of the concrete, for, as the report says:

"The resistance of concrete to percolating water is intimately associated with the quality of the aggregate, which in turn may affect the length of life of the concrete. The U. S. Bureau of Public Roads is conducting an elaborate series of tests on concrete specimens made from various kinds of aggregate selected from widely scattered localities. The purpose of these tests is to determine the comparative durability of aggregates when combined with different proportions of cement and sand. The concrete specimens are being subjected to alternate freezing and thawing over a long period of time. These tests have been under way for about two years, but so far nothing definite can be reported except that the 1:3:6 concrete is beginning to show disintegration.

"Other laboratories are also conducting research along these lines and an endeavor is being made to approximate the actual freezing and thawing conditions encountered by concrete in service. It will therefore take considerable time to obtain any reliable data. An examination of gravel concrete used with a 1:2:4 mix has indicated that under such conditions the concrete was sound after a number of years' exposure, whereas the same aggregates used in a 1:3:6 mix produced an unsound concrete and apparently some of the gravel disintegrated. A soundness test for gravel is needed which would indicate the durability of gravel in concrete.

"Some limestones will disintegrate if used in concrete, and examples of such structures are being studied. The sodium sulphate soundness test when applied to limestone appears to be on the side of safety, for no examples of disintegrated concrete have been brought to the sub-committee's attention where the unsound limestone could not have been detected by the sodium sulphate test. It may be found that five treatments are more severe than necessary to obtain a durable stone, and this feature of the test is being investigated."

Changes in Aggregate Specifications

A number of standards and tentative standards relating to concrete and aggregate were reviewed and some changes were recommended. These were:

Standard Method of Test for Unit Weight of Aggregate for Concrete (C 29—21);

Standard Methods of Making and Storing Specimens of Concrete in the Field (C 31—21);

Standard Method of Test for Voids in Fine Aggregate for Concrete (C 30—22);

Standard Method of Test for Organic Impurities in Sands for Concrete (C 40—22);

Standard Method of Test for Sieve Analysis of Aggregates for Concrete (C 41—24);

Standard Methods of Making Compression Tests of Concrete (C 39—25);

Tentative Methods of Securing Specimens of Hardened Concrete from the Structure (C 42—25 T);

Tentative Specifications for Concrete Aggregates (C 33—26 T).

Field Control of Quality of Concrete

A symposium on field control of quality of concrete had for its leading paper a discussion, "The Design of Mixtures," by R. W. Crum, engineer of materials and tests of Iowa state highway commission. The greater part of the paper was given to an explanation of the two main methods of designing concrete mixes, that of Abrams, by the water-cement ratio, and that of Talbot and Richart on the voids-cement ratio or mortar-voids method. A comparison of these methods was made and it was shown that practically equivalent results might be obtained by using either method. A problem of mixing, using the same aggregates, was solved by both methods and almost identical results were obtained as shown in the following table:

	Water-Cement Ratio Method	Mortar-Void Method
Water ratio, cu. ft. per bag	0.80	0.738
Proportions by weight......	1:2.24:4.56	1:2.28:4.57
Solidity ratio........................	0.865	0.853
Barrels cement per cu. yd.	1.35 to 1.31	1.319

Mr. Crum strongly advocates the mixing of concrete materials by weight, which is the method used on Iowa highways. The latter part of his paper dealt with batching by weight and volume and showed some of the many advantages of the weight method.

Transverse Tests as a Criterion of the Quality of Concrete

A review of papers on mixing and placing concrete is omitted, but a paper which followed these, on "Transverse Tests as a Criterion of the Quality of Concrete," is among those of especial interest to aggregate producers. It was read by H. S. Mattimore, who is engineer of materials of the Pennsylvania state highway department. Mr. Mattimore points out that in the design of highway slabs, tests to determine the modulus of rupture have practically replaced tests for compressive strength. The ratio between results of the two tests varies too much to permit rupture to be figured from compression test results, the variation being from 16% to 25%.

Variations in the compression test were found to be 14.5% as against 8% variation in the transverse test, an important matter since the number of specimens tested in the field is limited.

The simple apparatus used for breaking beams in the field by the Pennsylvania highway department was described and illustrated.

A paper on the field testing of concrete by Roderick B. Young, laboratory engineer of the hydro-electric power commission of Ontario, brought out that we do not yet know the relations between field tests and the actual strength of concrete and the subject should be thoroughly investigated.

New Method for Determining Soundness of Hydrated Lime

THE present standard method of the American Society for Testing Materials for determining the soundness of hydrated lime requires a minimum time of three days for completion, and the specifications permit much variation in check tests on the same sample. It would obviously be desirable to have a method which could be conducted in much less time with more nearly uniform results. Recently the U. S. Bureau of Standards investigated a method suggested, which consisted essentially of the duplication on small, thin specimens of the process used in the manufacture of sand-lime brick.

The test pieces used in the work were 1x4x¼ in., and the proportions of sand to hydrated lime were 9:1 by weight. A sufficient quantity of water to give a mixture which retained its shape when pressed by hand was used, and in practically all cases approximated 10% of the combined weight of the sand and lime. The pressure used in making the test pieces was 10,000 lb. per sq. in. for the major portion of the work and 6000 lb. per sq. in. for the remainder. The specimens made with the lower pressure were more difficult to handle without breaking, but the results on those not broken were just as accurate as upon those made with the higher pressure. The specimens were then steamed in an autoclave at 140 lb. per sq. in. pressure for five hours.

Specimens which contained unsound lime in the slightest degree completely disintegrated or cracked badly during the steaming process, and in every instance where the lime was unsound by the usual test the sand-lime brick test corroborated the results. It was, therefore, concluded that the sand-lime brick method is fully as accurate as the present standard method, while the time required for the completion of a test of lime for soundness is only one-third.

A Brief Analysis of the Function of Steam in a Lime Kiln*

By E. E. Berger

Progress Report Presented Before the Lime Symposium, American Chemical Society Meeting at Richmond, Va.

THE calcination of limestone is one of the earliest industries concerning which we have any record. The process was discovered accidentally and was carried out for some time before any attempt was made to control the reactions involved or to study the principles by which the process was governed. Recently considerable progress has been made in improving the methods used in the burning of lime but there are still certain processes employed concerning which little fundamental knowledge is available, and consequently there can be no definite measure of their value.

The use of steam in lime burning is an outstanding example of a process that is not clearly understood. Steam is used in the majority of lime plants but other methods have also been advanced for promoting calcination and for control of combustion. The relative merits of the different processes are not known. The high cost of installation and maintenance of steam boilers along with the indefinite knowledge concerning the real function of steam in the lime kiln led the Nonmetallic Station of the Bureau of Mines to undertake an experimental study of the effect of the steam on the calcination of limestone. The primary purpose of this investigation was to determine whether steam actually did have any effect on the calcination process. If it was found to have such an effect the plant was to discover the reason for the peculiar action of steam so as to make the results more applicable to lime kiln conditions. Furthermore, it was recognized that steam has an important function in the control of combustion and since the reason for this action is not generally understood a brief analysis of the chemical reactions of steam in the fuel bed is included in order that it may be utilized with greater efficiency.

This paper is a digest of a more complete report which is to follow. The complete report will be published as a technical paper of the Bureau of Mines.

Previous Investigations

The possibility of using steam to promote the calcination of limestone was considered as early as the latter part of the eighteenth century, but the results obtained by Herzfeld[1] in the Zuckerindustrie laboratories in Berlin are the only data generally available which give an actual comparison between the action of steam and air on the calcination.

In Herzfeld's experiments limestone was completely calcined in 45 minutes when subjected to a current of steam at 790 deg. C. and only 43% calcined when subjected to a current of air at the same temperature. These results have received wide publication and as a result many lime operators have been led to believe that steam will in some way aid the calcination of limestone and consequently it has been used extensively in the burning of lime. A careful study of the apparatus used in Herzfeld's experiments will reveal however, that even though the work was conducted with considerable care, the conditions of calcination were not under absolute control and consequently rather large errors were possible. This fact together with the lack of any adequate explanation for the possible effect of steam on the calcination of limestone made it imperative that further research be conducted on this subject before any definite theory could be formulated concerning the action of steam in a lime kiln.

THE rate of calcination of limestone in equal currents of air, steam and helium was determined at increasing constant temperatures from 600 to 1000 deg. C. The calcination rate was slightly different in each gas, but this variation is accounted for by the effect of the physical properties of each gas on the transfer of heat to the limestone and not to any chemical or catalytic effect which the gases might have on the limestone during the calcination process. It is shown that the difference in physical properties of the gas entering the lime kiln would not be changed sufficiently by the addition of a small quantity of steam to have any appreciable effect on the calcination process.

A study has also been made of the effect of steam and waste flue gas on the combustion of the fuel and an explanation is given for the action of these gases in preventing the clinkering of the ash and increasing the length of the flame.

Method of Experiment

In order to obtain a direct comparison between the action of air and steam on the calcination of limestone it was necessary for the conditions of experiment to be under such close control that no variable could affect the results other than the change from one gas to the other. The four following factors must be under definite control; uniformity of the sample, method of calcination, temperature of calcination, and the velocity of the gas passing over the limestone.

The limestone used in this investigation

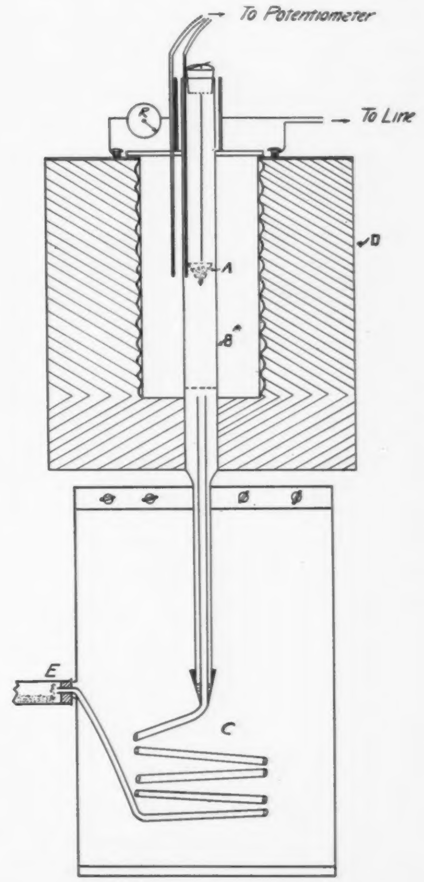

Fig. 1. Cross section diagram of apparatus used in determining calcination rate of limestone in currents of air, steam and helium. A—Limestone charge (2-gram) in platinum filter cone; B—Quartz calcining tube; C—Superheating coil in electric oven (100 deg. C.); D—Electric muffle; E—Drying tube for entering air and helium; F—Rheostat

was a high calcium stone from Bellefonte, Penn., analyzing 97.7% $CaCO_3$. It was sized to minus 3.96 mm. (5 mesh) and plus 2.36 mm. (8 mesh). This material was thoroughly washed to remove all fine material, then dried at 125 deg. C. and placed in an air-tight container where it remained until tested. Two-gram samples were used for each test.

Calcination was accomplished in a quartz tube (Fig. 1) which extended through the center of a vertical muffle furnace. The samples were placed in a platinum filter cone and covered with a piece of platinum gauze so that there would be a free passage of air both to and away from the sample without any possible loss of stone from decrepitation. A perforated plate in the lower portion of the quartz calcining tube prevented any irregular air currents from reaching the sample. After the weighed samples were placed in the filter cone they were suspended by a platinum wire to a definite depth inside the quartz tube, and allowed to remain for increasingly constant periods of time from 2½ to 60 minutes. The samples were then removed, cooled in a dessicator, and the degree of calcination determined by loss in weight.

The hot junction of one thermocouple was placed in the quartz tube near the sample to insure definite control of the temperature during the calcination process. A second thermocouple placed outside the quartz tube assisted in the temperature control so that it was quite possible to keep the furnace within ±5 deg. C. of the temperature desired.

The velocity of gas passing over the sample during calcination measured 115 c.c. per minute at 20 deg. C. This was the same for all gases used. The current of air was obtained from a reservoir by being displaced with a constant flow of water. The air was dried over P_2O_5 before entering the calcining chamber. The constant flow of steam was maintained by forcing it at constant pressure through a capillary tube submerged in an oil bath. The capillary tube opened directly into the superheating coil which preceded the calcining chamber. The current of helium which was used in order to determine the effect of the physical properties of each gas was obtained from a standard size cylinder and was dried by passing over the phosphorus pentoxide before entering the quartz tube.

Since the accurate measurement of this slow current of gas would involve considerable difficulty especially in the use of steam, better results were obtained by a frequent check of the gas current and omission of the flow meter. The rate of flow of air and helium was determined with a Victor Meyer apparatus while the flow of steam was checked by collecting the condensate and weighing it.

Results of Experiment

The results of this investigation are represented by the curves in Fig. 2 where the abscissae refer to the time in minutes and the ordinates represent the degree of calcination or per cent of the total CO_2 lost. Sixty minutes was the longest time that any sample remained in the quartz tube and the lowest temperature at which there was any appreciable loss in carbon dioxide during this time was at 600 deg. C. This temperature of initial calcination was the same whether the limestone was heated in a current of air or a current of steam. It will be noted, however, that at every temperature the rate of calcination was slightly greater

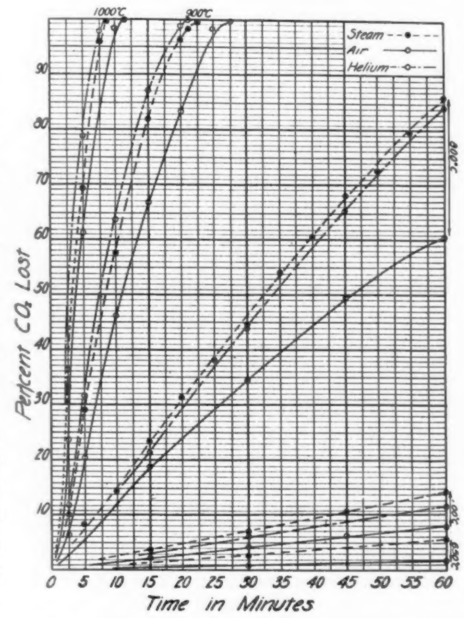

Fig. 2. Rate of calcination of limestone in currents of steam, air and helium

in a current of steam than it was in an equivalent current of air. Particular precautions were taken to maintain all conditions of calcination the same whether a current of air or a current of steam was supplied to the limestone, still there was a slight difference in the rate of calcination in equal currents of the two gases. No allowance could be made for the effect which the characteristic physical properties of each gas would have in transferring heat to the sample and consequently some tests were made with helium which is inert as far as any chemical or catalytic effect is concerned and it was found (see Fig. 2) that the rate of calcination in a current of helium was practically the same as in a current of steam. Therefore it is quite evident that the favorable action of steam is not caused by any chemical action which it may have with the limestone during the process of calcination.

Discussion of Results

Since the results have indicated that the rate of calcination of limestone in a current of steam is slightly greater than in a current of air it is desirable to interpret these results in order to determine as far as possible the various factors to which they may be attributed.

The effect of steam has been attributed by some to its chemical and by others to its mechanical action.

The chemical action of steam has been ascribed to the fact that it would replace the carbon dioxide and thus assist in removing it. However, it is now known that the decomposition pressure of calcium hydroxide is much greater at any temperature than that of calcium carbonate, and therefore our physical chemical knowledge of the properties of lime points out that there is no possibility of the carbon dioxide being replaced by the water vapor under normal conditions. Furthermore the results obtained in this investigation show that there is no evidence of a chemical reaction between steam and lime during the calcination process.

The mechanical effect of steam is supposedly due to its effect in sweeping the carbon dioxide out of the kiln so as to reduce its partial pressure around the stone or to the fact that after condensing in the pores of the limestone its subsequent violent expulsion would open the pores of the stone and facilitate the removal of the carbon dioxide.

In the laboratory tests, the velocity of the gases used was the same so that a variation in the partial pressure of carbon dioxide surrounding the stone could not have affected the rate of calcination. Furthermore Knibbs[2] has pointed out that a slight change in partial pressure would be of no advantage in a lime kiln; first because the volume of steam makes up only a small percentage of combustion gases, and consequently would have only a slight effect on the partial pressure of CO_2 in the kiln; and second this partial pressure would influence only the calcination of the outer skin of limestone for thereafter the stone is always surrounded by a film of carbon dioxide and the interior of the stone decomposes in an atmosphere unaffected by the composition of the gases surrounding it.

The condensation of steam in the pores of the stone was not possible in the laboratory tests since the samples were heated to 200 deg C. before being placed in the calcining chamber. In a lime kiln the stone remains in the preheating zone for considerable length of time so that the interior of the largest lump must be heated to a temperature much higher than that necessary for the evaporation of water before the outside of the stone reaches the calcination temperature.

The advantage apparent in the use of steam can be accounted for neither by its chemical nor mechanical action. Thus the only remaining factor which could account for the difference is the difference in the physical properties of the gas through which the heat was transferred in reaching the sample. It is not within the scope of this paper to undertake a detailed discussion of this phase of the problem but a brief explanation of the method by which the heat was transferred to the sample will show how the physical properties of the transferring medium could effect this reaction.

Heat Transfer in Limestone

Under the method of experiment the heat transferred to the limestone was the result of the following factors: radiation from the quartz tube, convection of the gas currents surrounding the limestone, thermal conductivity of the gases, and the molecular heat capacity of the gases. The transfer of the greater quantity of heat would be the result of radiation and convection and this would be the same for every gas used. The thin layer of gas between the quartz tube and the limestone sample, however, would permit the heat conductivity of the gases to function in the transfer of heat to the stone and a slight drop in the temperature when the sample was first introduced into the calcining chamber would show that the molecular heat capacity of the gas surrounding the stone would function in heat transfer also. Therefore there is every evidence to show that the difference in the heat conductivity and molecular heat capacity of the gases used would account for the difference in rate of calcination in the laboratory, however, if these factors do function in the heat transfer of a lime kiln their action would not be sufficiently changed by the presence of 5% of steam in the combustion gases to have any effect on the rate of calcination of the limestone. It has been shown previously that steam has neither chemical nor mechanical action on the limestone in the kiln and therefore it can be definitely stated that steam has no effect on the process of limestone calcination in a lime kiln. Whether the composition of gases over the fuel bed would be sufficiently changed by the introduction of steam under the grate to affect the transfer of heat to the stone, is a combustion problem which will be considered later.

Effect of Steam on Combustion

The action of steam in the lime kiln is not limited to its possible effect on the process of calcination; its chief function is to control conditions in the fuel bed. Carbon dioxide contained in the waste flue gas is also used to control conditions in the fuel bed and since its action is quite similar to that of steam it is desirable to study the action of each in order to determine as far as possible their relative merits.

Steam has at least two and sometimes three distinct functions in controlling conditions of combustion:—(1) It may prevent packing of a low grade coal so it can be made to burn almost as efficiently as the better grades; (2) It lowers the temperature in the fuel bed so that the utilization of a forced or induced draft does not produce the excessive temperature in the fuel bed which effects the clinkering of ash and destruction of grates; (3) It lengthens the flame thus producing a more uniform temperature in the kiln and as a result a better grade of lime.

Use of Steam to Cool the Fuel Bed

When steam is added the volume of gas passing through the fuel bed is increased about 5% and consequently a little more heat is required for the combustion gases to attain the temperature of the fuel bed.

The fuel bed of a lime kiln is composed of two zones, the oxidation or combustion zone and the reduction zone. The tests of Kreisinger and Ovitz[3] and others have proved that the only reaction which occurs in the combustion zone is the burning of carbon to carbon dioxide and that this reaction develops all the heat from the coal and is completed within the first three inches of the fuel bed. This zone is followed directly by the reduction which continues to the surface of the fuel bed. In this zone the steam and carbon dioxide are reduced simultaneously. The reduction of steam in the fuel bed is primarily the result of two endothermic chemical reactions, one of which results in the formation of hydrogen and carbon monoxide while the other produces hydrogen and carbon dioxide. At the temperature of a lime kiln fuel bed these two reactions occur together and their rates of reaction are practically the same.

It may seem on first thought that the short contact between steam and the incandescent carbon would not permit any appreciable reduction of steam but the tests of Mackie and Reed[4] show that the reduction zone of a gas producer is only about 12 in. in depth so that a 15-in. fuel bed of a lime kiln would have as deep a reduction zone and a higher temperature than that of a gas producer where tests have shown that approximately 50 per cent of the steam is reduced if 0.5 lb. of steam are added per pound of coal.

Action of Reduction of Steam in Preventing Clinkering of the Ash

The reduction reactions of steam absorb a large quantity of heat and consequently are very effective in cooling the fuel bed. The ash clinkers in the lower part of the reduction zone[3] about 3 in. above the grate, and then runs down through the fuel bed, solidifying when it reaches the cooler temperature. The fusion of the ash occurs at a point, the temperature of which is not affected by the gases entering the fuel bed, and very little by the rate of firing. The endothermic reactions between the steam and incandescent carbon occurs at the same portion of the fuel bed as the fusion of the ash and it is quite evident therefore that the heat absorbed by these reactions will control the temperature in the center of the fuel bed and prevent clinkering of the ash. Whether the steam acts mechanically in breaking up the clinker after it is formed is a matter for conjecture.

Lengthening the Flame

When the steam is reduced in the fuel bed, hydrogen and carbon monoxide are formed. These two gases combine slowly with the oxygen which enters with the air over the fuel bed and produce the long flame much desired in the burning of lime. Thus the heat which is absorbed by the endothermic reactions in the fuel bed is given back above the fuel bed by exothermic reactions and as a result there is a more uniform transfer of heat into the kiln and less difficulty in obtaining a good quality product. One point which should be emphasized in this connection is the fact that it is impossible to force enough oxygen through the grates to completely oxidize the hydrogen and carbon monoxide which are always present over the fuel bed. Therefore it is imperative that air be available over the fuel bed if the maximum amount of heat is obtained from the coal.

Amount of Steam Required and Approximate Cost

The amount of steam required will be affected by the type of coal, the rate of firing, the conditions of lime in the kiln and the design of the kiln itself so that no absolute figure can be given. The steam is used to prevent clinkering of the ash and for control of the draft. As a rule the former purpose requires the greater amount of steam which with poorer grades of coal may be as high as 0.6 lb. of steam per pound of coal. It has been found that when more than 0.3 to 0.4 lb. of steam are used, that the efficiency of the furnace decreases rapidly, furthermore the use of any steam will increase the heat loss from the stack of the kiln. Consequently the supply of steam should be under definite control and no more than the minimum amount should be used if the maximum efficiency is to be obtained from the kiln.

The cost of steam will vary with local conditions from 35 cents to 65 cents per 1000 lb. so if 0.5 lb. of steam are used per pound of coal, and if the kiln produces four tons of lime per ton of coal, steam will increase the cost of lime from 18 to 32 cents per ton. If the steam is allowed to condense before it reaches the grates it will absorb its heat of vaporization from the fuel bed so that the actual cost of steam will be increased by at least 35%.

Effect of Carbon Dioxide on Combustion of Fuel

For a considerable time the Eldred process has been used in the burning of lime. It consists in utilizing the carbon dioxide in the waste flue gas in place of steam to control combustion. The action of carbon dioxide is analagous to that of steam for it cools the fuel bed and lengthens the flame in the same manner, that is, by absorption of heat while being raised to temperature of the fuel bed, reduction of CO_2 in the fuel bed, and the subsequent burning of the carbon monoxide above the fuel bed to produce the desirable long flame. The carbon dioxide is reduced by the incandescent carbon to form carbon monoxide and it is particularly noteworthy that the results obtained by this endothermic reaction are almost identical with those obtained by the use of steam.

The only published data concerning the amount of CO_2 required to prevent clinker-

ing of the ash are the result of tests conducted by Azbe[5] in which it was found that 5% CO_2 in the combustion gases was sufficient to prevent clinkering of the ash. This would mean that about 17% of the combustion gas would be made up of waste flue gas. This would absorb practically the same amount of heat when its temperature was raised to that of the fuel bed as when 0.5 lb. of steam are added per pound of coal. This amount of flue gas would increase the heat loss from the stack (temp. 400 deg F) about 280 B.t.u. for each pound of coal burned while 0.5 lb. of steam would increase the stack loss by 575 B.t.u. The loss with steam is practically covered in the original cost and is not additional to it. The loss from flue gas would increase more rapidly with the temperature of the gas or with increase in CO_2 content of the combustion gases than the loss from steam so it cannot be said definitely that the stack loss from a kiln using steam is greater than from a similar kiln where waste flue gas is utilized.

It has been definitely proved by the investigations of Kreisinger and Ovitz[3], Audibert[6], Clements[7], and others that a large part of the CO_2 formed by the combustion of coal in the lower part of the fuel bed is reduced to carbon monoxide while passing through the incandescent carbon in the upper portion of the fuel bed. The amount of carbon dioxide reduced would increase with its concentration and since this reduction reaction absorbs a large quantity of heat the temperature in the fuel bed can be controlled by the CO_2 content of the primary combustion of gases. The primary effect of the waste flue gas on the fuel bed is a result of this endothermic reduction of carbon monoxide and it is therefore this reaction which cools the interior of the fuel bed and prevents clinkering of the ash.

The carbon monoxide which is formed in the fuel bed is oxidized again by the secondary air which enters over the fuel bed. Thus the heat which is absorbed from the fire box is given up again at a point where it will be more effective in burning the lime. This secondary combustion produces the long flame which is instrumental in producing the more uniform conditions in the burning zone of the kiln. The radiant heat from the secondary combustion will be affected by the composition of the gas over the fuel bed and therefore a change in the primary combustion gases may have an indirect effect on the transfer of heat to the limestone.

Conclusion

1. The first appreciable loss of carbon dioxide from a high calcium stone occurred at one hour's heating at 600 deg C.

2. The limestone was calcined at a slightly faster rate in a current of steam than in a current of air, but this was due to the effect of the characteristic physical properties of each gas in transferring heat to the sample and not to any chemical or catalytic effect which either gas had on the limestone during the process of calcination. It is pointed out that these physical characteristics would not affect the rate of calcination in the lime kiln.

3. The use of waste flue gas or steam is effective in preventing clinkering of the ash. This action is brought about primarily by the large amount of heat which is absorbed by the endothermic reaction between steam or carbon dioxide and the incandescent carbon in the fuel bed.

4. The partial reduction of steam or carbon dioxide increases the percentage of combustible gases over the fuel bed. The secondary oxidation of these gases by the air which must be available over the fuel bed produces the long flame which is so effective in producing the mild uniform temperature much desired in the burning zone of a lime kiln.

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New Process for Recovery of Valuable Mica Wastes

THE recovery of highly valuable mica wastes, hitherto lost in the ground mica industry due to incomplete settling of fine materials in the wet grinding process, is promised as the result of experiments conducted by the United States Bureau of Mines, Department of Commerce, at its Non-Metallic Minerals Experiment Station, New Brunswick, N. J. The solution of the problem is indicated in the application of electrolytes as flocculating reagents. As finely-ground mica is a high-priced product, attaining a value of $100 to $120 per ton, the losses from this source attain proportions that seem to demand a remedy.

In the mining of mica, a considerable tonnage of material is produced which is so damaged by rumpling, folding, the presence of impurities and lack of size that it cannot be manufactured into sheet goods, points out W. M. Myers, associate mineral technologist, in a report just issued by the Bureau of Mines. In the early days of the mica industry this material was considered worthless and no effort was made to recover it. The discovery that ground mica produced from this scrap is of value to many industries has resulted in the profitable disposal of most of such material now being produced as a by-product at the mines. The supply of scrap mica from this source is augmented by the trimmings produced in the manufacture of sheets; by mica not suitable for sheet goods produced as a by-product in the operation of feldspar mines and clay pits, and by production from mines which are operated for scrap alone. This utilization of scrap mica has been a benefit to many mines, as it has afforded a source of additional revenue sufficient to justify the operation of properties which could not produce sheet mica alone in quantity having a value great enough to pay for the cost of production. The market absorbs from 5000 to 9000 tons of ground mica per year.

The principle of the application of electrolytes for deflocculation of fine materials in order that impurities may settle out, and the subsequent flocculation of the suspended particles by a different reagent, is well known and has been applied successfully to clays. Flocculation is also applied with success to ore slimes. Thus certain electrolytes, particularly alkalies, added to a suspension of colloidal particles, cause deflocculation so that suspension may be maintained indefinitely. The addition of other electrolytes, particularly acids, on the contrary, produces flocculation, and the particles are rapidly precipitated from suspension, leaving a clear liquid above the precipitated mass. Salts of trivalent elements, such as aluminum, act similarly. Due to its cheapness, the double sulphate of aluminum and potassium, ordinary alum, has been used extensively for treating clays.

In order to determine the effect of electrolytes on the flocculation of fine mica, a series of experiments was conducted at the New Brunswick Station of the Bureau of Mines. Sulphuric acid, hydrochloric acid, potash alum, aluminum sulphate, and chrome alum in which the aluminum of ordinary alum is replaced by tri-valent chromium, displayed efficiency as flocculators. Choice of a proper flocculator is dependent upon cost and also upon its effect on the mica, as reagents injuring the quality of the product would be undesirable. Sulphuric acid, aluminum sulphate and potash alum appeared best.

Neither sulphuric acid nor aluminum salts in these quantities displayed any injurious effect upon the quality of the mica. The greater portion of the electrolyte is removed when the clear liquid is drawn off from the precipitated mica.

The results of the Bureau of Mines' experiments represent laboratory tests only, and it is highly desirable to obtain corroborative evidence at mica grinding mills. Considering the low cost of the alum or other electrolyte, the simplicity of the operation, and the high value of the recoverable mineral, the method bears promise of successful application.

Details of these experiments are given in Serial 2798, "The Use of Flocculating Reagents for the Recovery of Fine Mica," copies of which may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

Gradation of Machine-Broken Stone*

Part V. Effect on Character of Product by the Shape and Condition of Crushing Surface

By Wm. T. W. Miller
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ONE of the most important factors influencing the character of the product from any crushing machine which comprises confining faces would appear to be the shape and condition of the crushing surfaces.

Jaw crushers may have toothed or plain jaws, and wear on the former will produce a surface equivalent to the latter.

Gyratory crushers may be fitted with smooth or corrugated heads and concaves, and here again wear neutralizes the effect of the fluted crushing faces.

Rolls may have toothed, corrugated, or plain shells, all of which may lose some of their value if the contact faces wear irregularly.

In the jaw and gyratory crushers the longitudinal corrugations reduce the actual area in contact with the material and confine the size of the product in at least two dimensions. Plain surfaces control one dimension only, which is the thickness.

Toothed or corrugated roll shells minimize the areas of maximum pressure and substitute a beam action for shattering by squeezing. To a limited extent they also control the maximum size of the crushed material in two dimensions.

It is difficult to show clearly the effect of wear on the crushing surfaces, since the product deteriorates and strict comparisons are rarely obtainable. Diagram 16 shows two sizing tests made on the same material and in the same machine, the one when the jaws were new and the other when the jaws were worn at the bottom end although the teeth remained sufficiently good at the top for the jaws to be reversed and give considerable further life.

Test No. 2 should therefore be taken as showing the results obtained from jaws which are in the middle period of their working life.

In this instance the teeth were still effective in the upper part of the crushing cavity, and although the change in the curve was noticeable it was not very decided.

Diagram 17 carries the comparison a stage further. These tests were made on two similar machines, one fitted with toothed and the other with plain jaws, and the effect of the latter is most marked. It is quite evident that the ridged surfaces do not shatter the stone to the same extent as the smooth jaw-plates.

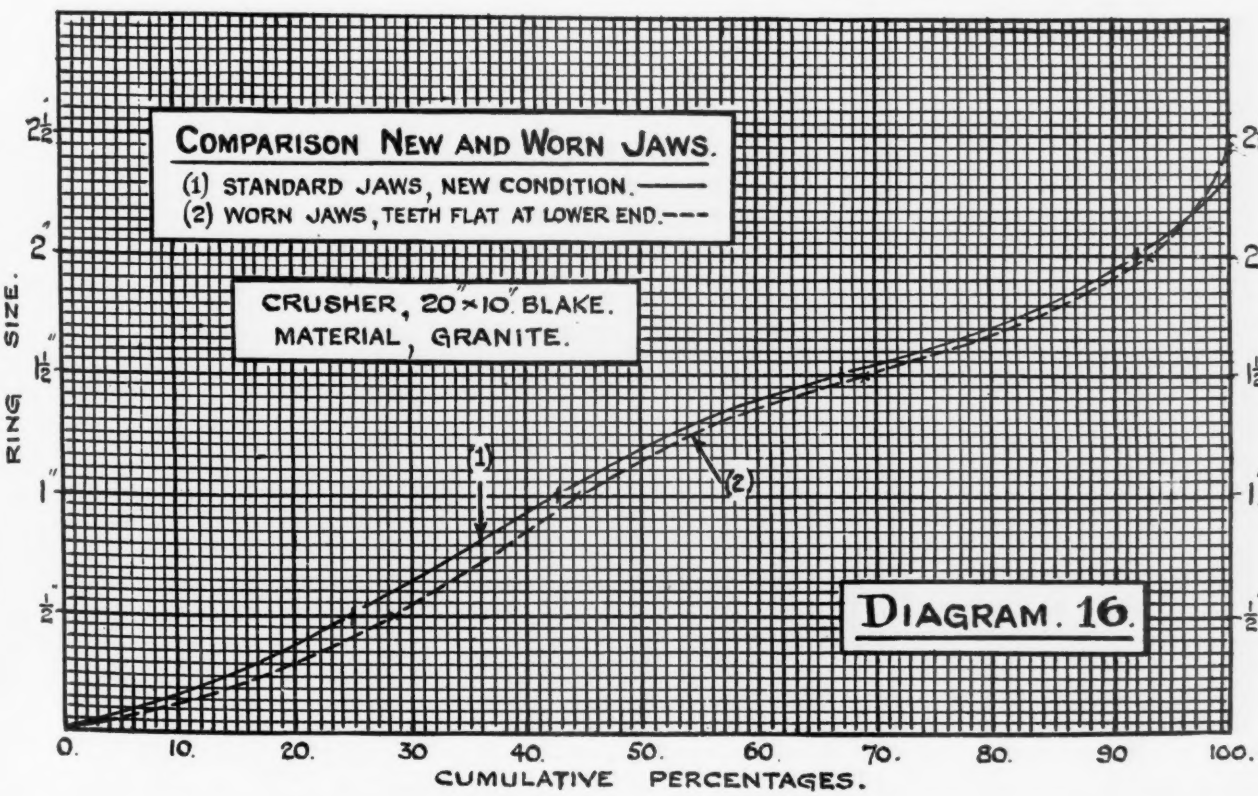
Since the results obtained from the plain jaws will be almost identical with those given by the toothed jaws when these are worn to the utmost extent by reversing them end for end, it must be obvious that the gradation of the product changes very considerably during the life of a set of jaws, and this should be carefully taken into account when estimating the probable gradation of the output of the machine.

Sometimes, when the jaws are made with sharp teeth, these hold up the stone for a time until the ridges have become blunted by wear. Any retarding action of this kind, which delays the movement through the crushing cavity, is sure to affect the product.

Diagram 18, showing typical gradation curves from No. 6 gyratories fitted respectively with corrugated and plain crushing surfaces, is a striking example of the change in character of the crushed material due to the closer sizing and freer breaking from the corrugated faces.

In this case the shape of the corrugations was especially suited to the grade of product

*Copyright, 1927, by W. T. W. Miller.

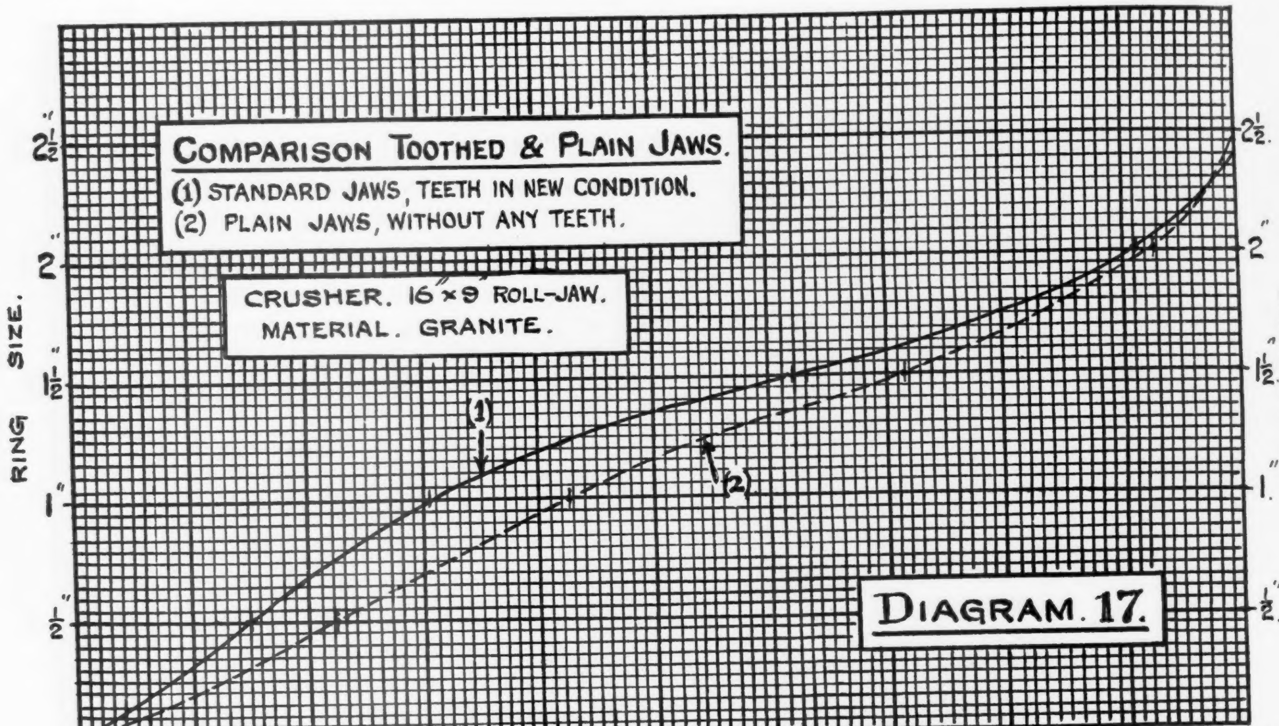


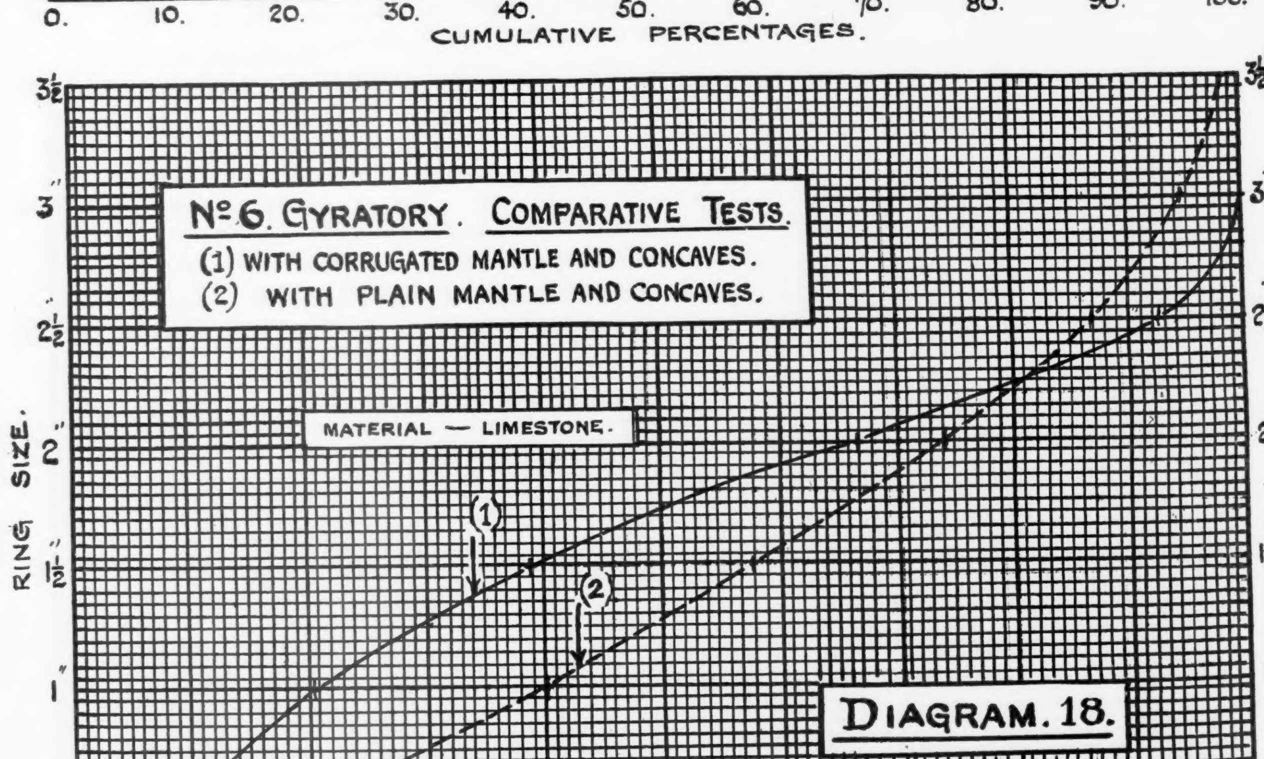
desired and both mantle and concaves were in new condition.

As is natural, the variation in the gradation of the product during the life of the crushing faces is much more apparent when corrugated parts are fitted than in those cases where the surfaces are smooth to begin with.

W. T. Bradley Building New Lime Plant Near Harrisburg

WALTER T. BRADLEY is having plans drawn for a new 100-ton per day lime plant which is to be built at Swatara, Penn., about 10 miles from Harrisburg. Four York gas-fired kilns will be installed with an R. D. Wood gas producer for supplying the gas. The plans include mechanical equipment for the automatic handling of finished lime from the draw to the cars. Contract for the erection and installation of equipment has been awarded to the McGann Manufacturing Co.





Union Rock Co. Expands

AT a recent sales meeting held at the Jonathan Club, George A. Rogers, president of the Union Rock Co., Los Angeles, Calif., announced the purchase of the properties of the Orange County Rock Co., the Yaeger Rock Co. and the Kavanagh & Twohy Rock Co., all situated near the city of Orange, in Orange county. The purchase price was half a million dollars, and with the contemplated improvements and enlargements of these plants the total investment of the company in Orange county will be in excess of $1,000,000.

Mr. Rogers says: "We are adding these three units to our ownership, in line with our general policy of being prepared to give direct service, either retail or wholesale, to all parts of Southern California. Hitherto we have never been directly interested in plants or distributing stations in Orange county, but we are now prepared to give this important section adequate service at all times, even under maximum demand.

"The Orange county rock plant is situated on the Southern Pacific railroad at McPherson and has a production capacity of approximately 2000 tons per day, and will be available for both carload and truck shipments. The Yaeger Rock plant is situated about three miles south of McPherson and has a capacity of about 1800 tons per day and will be used exclusively for truckload deliveries. The Kavanagh & Twohy plant is situated about two miles south of McPherson on the Southern Pacific railroad and will be available for both carload and truck shipments.

"This combination, under one management, assures Orange county of adequate service, under maximum demand, as well as uniformity of material. In line with our general policy, the company proposes to market only the most carefully prepared materials, and to carefully wash all sand, which we have found to be safer for the important construction activities of Southern California, and indeed has been found by all authorities all over the United States to be the only safe method to procure uniformity in this important commodity. Washed plaster sand, by the way, has recently been introduced by the Union Rock Co. and has been meeting with great success, and this commodity will be manufactured by us in Orange county. It is proposed to operate all three of these units as the demand requires, and no curtailment in employment of local labor is expected to follow the purchase.

"Economy in management of operation has been the watchword of the Union Rock Co. and has made it possible to establish prices in the district it serves which are invariably lower than those in existence in other centers of the country, the prices being in the neighborhood of 25c per ton lower than those in existence in northern California and 50c per ton lower than those in effect in many of the large Eastern and Middle Western centers. The rock business has developed to a point where only great volume over a wide area can make a rock company successful, which statement you will recognize as being particularly true when you realize that a producer cannot hope for greater than a maximum of 10c per ton profit on material marketed.

"In line with the company's policy in other communities where we have been operating, we expect to take a keen interest in everything affecting the welfare and growth of the city of Orange and Orange county."

Officials of Union Rock Co. at sales meeting at Jonathan Club. Left to right: H. V. Goodrich, assistant secretary; L. L. Rogers, vice-president; M. McIntyre, service manager; R. E. Rogers, secretary; W. J. Van Valkenburgh, sales manager; G. A. Rogers, president; Robert Mitchell, assistant secretary; Leon Rosenbaum, credit manager; T. C. Rogers, treasurer

Sand and Gravel Plant Resumes After Flood

THE Cumberland Sand and Gravel Co. of Estill Springs, Tenn., has resumed operations after being put out of business by a flood which washed away the company's railroad bridge and damaged the plant. About 20 carloads are being produced daily.

Railroad Quarry Workers Strike

WORKERS in the Chicago and Northwestern quarry at Le Grand, Iowa, struck recently on the ground that the wages paid in the quarry were not on a parity with those paid in other quarries owned by the railroad.

The scale at the Le Grand quarry is said to be 35c an hour for common labor, 45c an hour for drillers and 60c an hour for steam shovel men. In other quarries, it is claimed the scale ranges upward to 90c an hour. The laborers at the Le Grand quarry receive less than the men on the company's section crews.—*Marshalltown* (Iowa) *Times.*

County Highway Officials Organize

THE American Road Builders Association has just completed the organization of a national County Highway Officials Association, a body of local road officials representing each of the 3,070 countries in the United States. The new organization will function similarly to the American Association of State Highway Officials, and will be known as a division of the American Road Builders. At its annual convention and road show, the County Highway Officials will have the advantage of the annual sessions of its parent organization.

The organization meeting was held at Washington on June 17th, at which time a constitution was adopted and officials elected.

Thomas J. Wasser, supervising engineer of the Board of Chosen Freeholders, Jersey City, N. J., was elected first president. Four regional vice-presidents were elected. They are: Charles E. Grubb, Wilmington, county engineer of Newcastle County, Del.; Edward W. Hines, Detroit, road commissioner of Wayne County, Mich.; John Kirkpatrick, county judge, Wayne County (Benton), Kansas; and Stanley Abel, county supervisor, Taft, Cal.

Sale of Pennsylvania Gravel Company

THE Hudson Sand and Gravel Co., of Kittaning, Penn., to James M. Hudson of Kittaning, is reported in a local paper. The company was owned by local capital. The plant has been sold outright and the land leased for five years.

"Sil-a-Site," Reported New Building Material

A FACTORY is being built in Atlanta, according to the *Atlanta Journal,* in which a new building material called "Sil-a-Site" is to be made. It is said that Sil-a-Site can be cast into tile, brick or any other form that can be molded and that it may be glazed.

Officers of the company are reported to be: B. Reynolds, president, formerly of Los Angeles; A. D. Walters, vice president and business manager, who comes from Minneapolis, and C. B. Gallaher, secretary and treasurer, who will come to Atlanta.

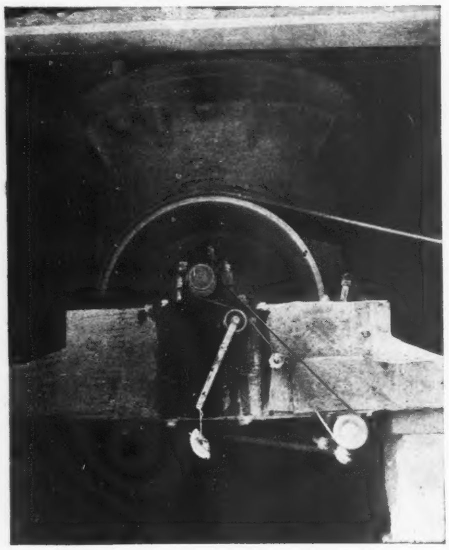
Homes for the officers of the company will be the first Sil-a-Site structures.

Hints and Helps for Superintendents

Increasing the Capacity of an Old Gyratory Crusher by Forced Lubrication

By J. A. THIESSEN
Superintendent, Linwood Cement Co., Davenport, Iowa

AT our plant the secondary crusher is a one-speed No. 7½ ordinary gyratory which was until recently equipped with an old style plunger pump. The speed with



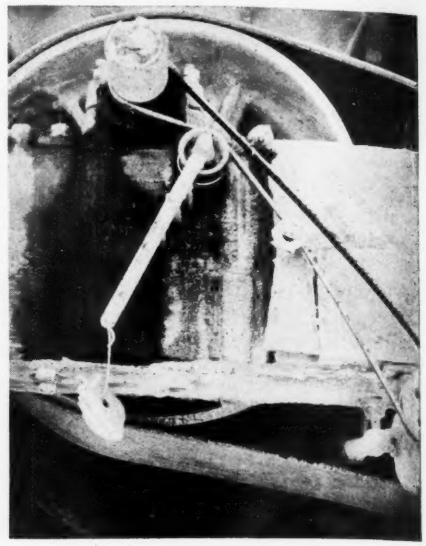
Installation of a new lubrication system on gyratory crusher increased the crushing capacity

the old pump was 425 r.p.m., but with the addition of a 1-in. gear pump with by-pass this was increased to 475 r.p.m. Further, with the old style pump, there was continual trouble with pump stoppage during the warm weather; this trouble was eliminated by the change to the gear pump.

The new pump is one that can be purchased at a low price from several manufacturers. To attach, the intake is connected at the same suction as the old plunger pump. There must be a check valve between the intake of suction and gear pump line and this suction line is connected to gear pump and the discharge of pump is run to where the old discharge was connected in excentric through holes where the old pipe went into excentric and the old pump was removed and also plunger rod.

This pump has been on this crusher for over 2½ years without ever being touched. The belt is driven off of the counter shaft onto a 5-in. flange pulley with 1-in. belt and any tightener could be put on the belt to keep it in tension. In this case it was a pulley from an automobile fan.

This crusher crushed on an average of 100,000 tons of stone per year and is only rebabbitted once a year and the babbitt was then found in good shape outside of the ordinary wear.



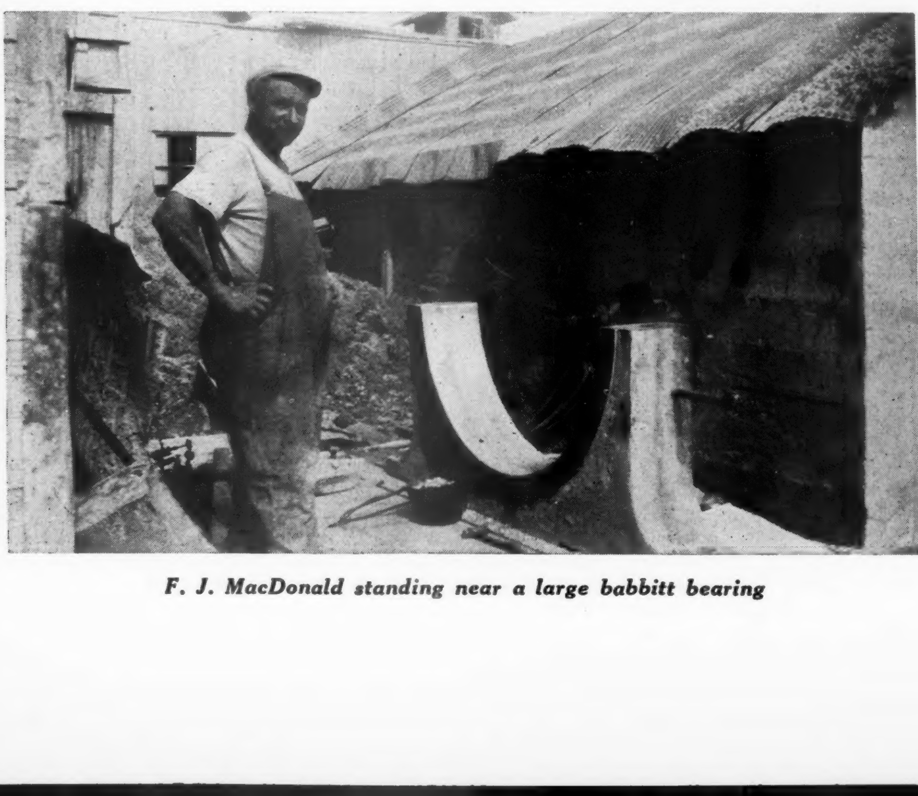
Close-up showing the details of the new lubrication pump installed on the old gyratory crusher

About Bearings

By F. J. MacDONALD
Cobleskill, N. Y.

MUCH has been written and said on the very important subject of "bearings," but still there is much more to learn. There is a prevailing carelessness in their proper care, lubrication and adjustments.

When the primitive settlers began to develop this country all the old mills were fitted with wood shafts and bearings, and lubricated with beef and mutton tallow, for mineral oil was unknown at that time.



F. J. MacDonald standing near a large babbitt bearing

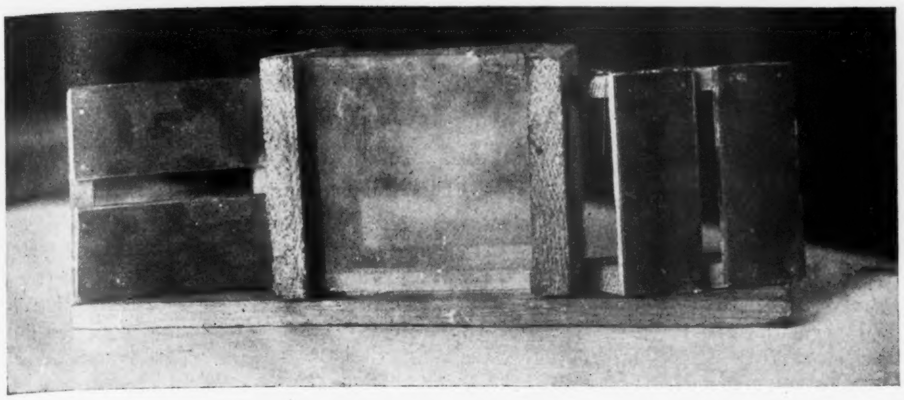
Finally gudgeons were devised, to be fitted in the end of a wooden shaft to form a bearing or axis that revolved in a wood bearing.

Later came the invention of an amalgam metal (called babbitt), named after its inventor, Isaac Babbitt, which was a wonderful stride in mechanical improvement. After the advent of the first bicycle, hardened steel cone bearings were used, and they were still improved by the wonderful ball bearing, which still holds its own as a friction eliminator. When a machine has to be operated by human power the right bearings are all important. A bicycle without ball bearings would be absolutely useless.

Roller bearings of various types have been designed. Solid rollers, hollow tubular rollers of the ribbon rolled or Hyatt type, used very extensively where a nicety of adjustment is not essential, and the Timken type, with taper rolls which allow of a very fine adjustment after years of service.

With all our knowledge of bearings there are still some very grave mistakes made. I have in mind a large lime pulverizer or tube mill that is fitted with a 3½-ft by 10-in. babbitt bearing. The cylinder or tube with linings weighs around 40 tons. Imagine turning such a mill on a 3½-ft. bearing. The power requirements are excessive.

Mills of such an unusual size should by all means turn on trunnion wheels (with manganese steel tires and rims). The mill was operated by a 200-hp. electric motor, but it was claimed to run with less power (which it would not do). The purchaser pays the price in excessive power costs. Such a mill with trunion wheels could have



Model of device for mixing aggregates at Weston and Brooker plant

been operated with at least half as much power. Figuring the difference between a 200- and a 100-hp. motor (first cost and operating cost) during the operating of the mill, it should make designing engineers and operators stop and take notice before they build.

Poor care of ordinary babbitt bearings causes serious shutdowns and needless repairs at many large plants. I have in mind a large cement plant where several are employed almost constantly rebabbitting worn bearings. Many are worn excessively from no other reason than the want of lubrication—through a faulty system or the human oiler.

Many times (in rebabbitting) proper oil grooves are not provided. You do not expect oil to run out of a bottle tightly corked; neither will oil work under a shaft or axle that carries a heavy load and worn or burned to a perfect fit in a babbitt bearing (without proper oil grooves cut in the bearing). The only thing for the babbitt to do is to melt and run out, which it usually does and the owner wonders what makes the bearing give so much trouble.

I have seen bearings that were given reasonable care run for years under heavy service while others were a continual source of trouble through neglect.

At crusher and cement plants, in dusty places, if bearings are covered (with old pieces of belt) and properly protected their usefulness or wearing qualities can be more than doubled.

It is wonderful economy to see that your bearings are given due consideration, and that they are properly oil grooved and regularly supplied with the necessary amount of oil or grease.

A dependable human oiler is all important, under the direct supervision of a head oiler.

Many things are used to cool or prevent bearings from overheating. Each engineer has his formula—salt, pulverized soft coal, white lead, tallow, hard grease, graphite, etc. Graphite is one of my favorites. Perhaps like a medical treatment, what cures one will not another (various trials will do no harm), and sometimes a complete overhauling will be the only cure—rebabbitting, oil grooving, aligning and scraping, etc.

I have seen bearings altogether too short or narrow for the shaft diameter. The rule runs from three to five times the shaft diameter, and a wide bearing distributes the weight or pressure over a larger area and usually gives less trouble from overheating.

Portable Pump for Supplying Dragline with Water

A PORTABLE pump is often a handy thing to have at either a quarry or a gravel plant. The picture shows one at the Dixie Sand and Gravel Co.'s operation at Petersburg, Va. It was made by mounting a small force pump and a gas engine on the bed of a truck trailer. Both pump and engine are of the sort built for farm use and sold by hardware stores all over the country.

Portable pump for supplying a dragline with water

As shown in the picture it is supplying water to the boiler of a steam driven dragline excavator. The dragline was working about a half mile from the washing plant when the picture was taken, and it had been working at a distance of nearly a mile.

When the dragline started its cut it was near the plant and was supplied with water from the wash water lines of the plant. But as it worked farther away the cost and trouble of keeping up the long line, and the expense of pumping through a long line of such small pipe then used, caused another method to be sought.

After the pump has been moved into place one rear wheel of the trailer is taken off and the bed is supported by blocks. This makes a steadier foundation for the engine and allows more room to work on it.

Devices for Mixing Aggregates

AT the Weston and Brooker quarry, Cayce, S. C., a great deal of business is done in mixed sizes. These are mixed on a conveyor belt that runs below the bins, but it was found that the mixing was more thorough if the discharge of the conveyor was passed through the device of which a model is shown above.

Steve Weston, who is the inventor of the Weston crusher and other machines, is responsible for the device, and the model shown is one that he made to study its working. The box in the center is of glass. There is a bottom (removable) and a horizontal partition. Each of these has a slot running across the box, but the slots are set at right angles, so that they form a cross. The bottom of the partitions are shown removed to illustrate this point better.

By passing various combinations of sizes through this model and screening the resultant mixtures, Mr. Weston found that the principle was correct and then he built a box of this kind of steel and placed it where the discharge of the conveyor would flow through it as cars were loaded. Samples taken from the cars and screened showed that the mixing of sizes was much better than it was when the stream from the conveyor was discharged directly into the cars.

Contractor's Hoist as Car Puller

THE equipment used by contractors which has become out of date may sometimes be picked up cheap and made useful around a quarry or gravel pit. The cut shows a contractor's steam hoist used at a sand pit as a car puller. With the comparatively light service given it in such work it will last for a long time. The picture was made at an Alabama sand plant.

Old hoist converted to a car puller

Louisiana Portland Begins Production

THE Louisiana Portland Cement Co.'s plant at New Orleans, La., began production recently and is now turning out 2200 bbl. daily, according to New Orleans papers. This company is one of the 11 International Cement Corp. subsidiaries in the United States and sells its product under the Lone Star brand.

The new plant stands on the Industrial Canal and receives part of its raw material from a limestone quarry on the Tombigbee river, north of Mobile, Ala. The clay used with this is the silt from the sedimenting basins of the city water purification plant, of which a large quantity has accumulated in past years. The limestone is brought in by barges and the first shipments were received recently as described in the June 25 issue of Rock Products. The clay is being brought in by railway cars.

The first shipments of limestone were brought in by a towing company but the Louisiana company will have its own new fleet of barges and tow boats in operation shortly. Full Diesel power is used on the tow boats. The tow is a long one but it is through an inside passage and favorable conditions may be counted upon throughout the year.

According to New Orleans papers about 150 men are employed at present. L. R. Ferguson is general manager, B. F. White is sales manager, A. C. Harragin is assistant secretary and treasurer, and A. D. Stancliff is in charge of operations at the plant.

The first barrel of cement produced was purchased by the dock board of New Orleans.

Florida Portland Developing Brooksville Quarries

THE opening of limestone and clay quarries at Brooksville, Fla., which will supply raw material daily to the Florida Portland Cement Co.'s portland cement plant at Tampa is almost completed. Shipments to the plant on Hooker's Point will start about July 15, according to officials of the Cowham Engineering Co. of Chicago, which is building the new plant.

Approximately $200,000 is being spent on this phase of the work. The rock quarry is on 520 acres of land seven miles northwest of Brooksville, which the company has connected with the main line of the Seaboard Air Line Railway by a railroad 4⅕ miles long with incoming and outgoing storage tracks at the quarry having a capacity of 50 cars each and auxiliary tracks at the Seaboard junction to hold 40 cars. The Seaboard has named this junction Rockland. The line to the quarry will be known as the Rockland spur.

Two carloads of dynamite have already been used at the quarry to blast a cut into the limestone hill three-quarters of a mile long to a face 35 ft. deep. Two heavy drilling machines and two steam shovels have been busy for months doing this work and removing the overburden of soil and loose rock above the quarry deposits.

The clay pit, which is on a 50-acre tract half a mile south of Brooksville, is completed. A short service track and storage tracks have been built. One steam shovel will be kept here for loading.

Operation of the Tampa plant will require 35 carloads of rock and 10 carloads of clay daily. The company will have its own locomotives at the quarry and at the Tampa plant.—*Tampa* (Fla.) *Tribune.*

Monolith Portland Prepares Another Big Shot

THE Monolith Portland Cement Co. of Los Angeles, Calif., is preparing to set off 180,000 lb. of dynamite in its quarry at Monolith shortly. This company has already fired several such big shots, but this is said to be the largest to be shot anywhere on the Pacific coast, according to the *Los Angeles Express.*

Wichita, Kansas, Sand Company Wins Injunction Suit

THE Consumers Sand Co., of Wichita, Kansas, recently asked that the state executive council be enjoined from interfering with its sand pumping operations in the Arkansas river. The court granted the injunction.

The company has been pumping sand from the river above the Wichita water works and the complaint was made that the sand company was interfering with the city water supply when the river was low. The state executive council ordered the sand company to quit taking sand from the river at that point when the stage of the river reached a low level. Injunction proceedings followed.

Judge McClure in his decision pointed out that the deepening of the river channel did not affect the volume of water, except to act as a drain to the underground water in land adjacent to the river channel and there still was an abundance of water available to supply a city several times as large as Wichita.

He ruled the order made by the executive council is discriminatory as it favors Wichita against the other citizens of Kansas. Testimony showed the sand company sells most of its sand outside of Wichita.—*Wichita* (Kansas) *Beacon.*

Flood Helps to Shut Down Cement Plant

THE Monarch Cement Co. recently suspended operation, temporarily, of its plant at Humboldt, Kan. One of the principal reasons given was that floods had retarded construction work in parts of its territory.

Cement Company Threatened with Dust Suit

THE Federal Portland Cement Co. of Buffalo, which has a plant at Woodlawn, N. Y., has been threatened with court action by the town governments of several surrounding villages, according to the *Buffalo* (N. Y.) *Courier-Express.* Residents complain that dust interferes with health and comfort and ruins gardens. The company told the townspeople that it is installing means for collecting the dust, but that it will be about six weeks before the installation can be made. The townspeople then requested that the company cease production until the dust collectors are installed. The health board of the town of Blasdell proposed to force the company to shut down by the authority conferred upon it by the state health law.

Northwestern Portland Buys Machinery

MACHINERY for the new plant of the Northwestern Portland Cement Co. at Grotto, Wash., was purchased recently. Kilns and grinding mills were bought from the Traylor Engineering and Manufacturing Co.

The principal units of the machine equipment are a 240-foot rotary kiln with inside diameter of 11 ft. 3 in., and two 7x40-ft. three-compartment ball mills for use on raw and finished grind. The kiln is of the single-roller type with four supports. The kiln alone weighs 770,000 lb. and the mills will weigh 210,000 lb. each. Approximately 900 hp. will be required for each mill.

This machinery in operation will produce approximately 2000 bbl. of finished cement per day, it is estimated by the manufacturers.

Construction of the new plant at Grotto is now under way and progressing rapidly, according to officials of the cement company, who expect to have their product on the market late this fall.—*Seattle* (Wash.) *Journal of Commerce.*

Collapse of Gravel Plant

A BUILDING belonging to the Morse Sand and Gravel Co., Tiffany, near Attlesboro, Mass., collapsed recently, burying a gasoline engine and two trucks under sand and rock. Damage was estimated at $8000. No one was injured.

Two Maine Lime Companies Merge

IT has been announced by George B. Wood, president of the Rockland and Rockport Lime Corp., of Rockland, Maine, that his company has taken over the Edwards Bryant Co. Both companies have plants at Rockland and at Rockport, Maine, and the Rockland and Rockport Co. is one of the largest lime producers in the country. The announcement says that many details will have to be worked out before active control is taken.—*New York Journal of Commerce.*

Editorial Comment

Developing Home Markets for Cement

A rather significant statement regarding the Belgian portland cement industry is included in a report on Belgian business conditions, cabled to the United States *Commerce Reports* by the commercial attache at Brussels, under date of June 17. This statement is: "A reduction in the American demand for cement has been offset by heavy shipments to other markets, and the cement industry continues prosperous; prices show a firm tendency." In other words, the campaign to exclude Belgian cement from this country in favor of the home-made product is not injuring the Belgian industry; obviously it was not intended to. On the contrary it will actually help the Belgian industry in the long run by forcing it to develop its home markets, or markets near home, which ought to be done with more profit to Belgian producers, than to reach out after far away business that already belongs to some one else.

Their American portland cement brethren have given European manufacturers a splendid example of how to increase domestic consumption. If Europe could be educated to use only a fraction of the annual consumption of the United States, Belgian and other European portland cement manufacturers would be hard-pressed for many years to come to meet demands.

That is another thing that differentiates portland cement importations from importations of other materials. American portland cement manufacturers, by intensive and intelligent promotional work extending over 20 years, have largely created the demand for portland cement—at no small sacrifice of time, energy and money. It is not morally right that this demand, created at such a price, should be filled by foreign manufacturers who have contributed not one cent of money or brains to its creation. Let them spend their efforts in creating a home demand, which is far less "impossible" now than the same problem was to American portland cement manufacturers 20 years ago.

A. S. T. M. Meeting

The recent meeting of the American Society for Testing Materials marks the end of a quarter century of astonishing progress. The place of the society is now so fixed that it is recognized that our modern industrial life would be impossible without some such agency to solve the joint problems of user and producer. It has brought out the underlying fairness of modern industry, the desire of the producer to make the best product that he could and the reasonableness of the user in demanding no more than the industry could regularly furnish.

One reason for the success of the society's specifications is that more than 100 trade associations are represented in its membership. It follows that specifications represent the experience of an entire industry instead of individual opinions and prejudices.

Sand and Gravel Specifications

In discussing the work of the standardization committee of the National Sand and Gravel Association with producers, there has been found a wide-spread opinion that sand and gravel specifications should go beyond the usual limits. It is thought that the association should set up an ideal material as a mark to shoot at. It is not expected that every producer, or many producers, can hit the mark, but it will be there and it will be the standard by which all production will be judged.

The desire for such a specification has come from the wish to get rid of a form of competition with which the sand and gravel industry is especially plagued, that of wayside pit production and poorly prepared material. It is quite a proper wish and it is as much for the welfare of the public as for the industry. For there are always people who will buy such stuff, merely because it is cheap, and who are not affected by the knowledge that the concrete made from it will be unsound.

At the same time, an ideal specification is not a usable one. The greatest specification making body in the United States, the American Society for Testing Materials, has always drawn and adopted only such specifications as the plants in an industry could meet with normal every-day production. Such a specification protects both the buyer and the seller, assuring the one that he is certain of receiving material of a certain definite quality and the other that he will not be asked to furnish anything that cannot be found in his ordinary, normal product. This form of general specification is the only form that has stood the test of experience.

It is not going to be easy to draw such specifications for sand and gravel. The bank material varies widely in different parts of the country and what is permissible in one part may not be permissible in another, on account of different climatic conditions, or on account of raw materials which positively cannot be refined beyond a certain point. But there are certain characteristics which we know that all good aggregates possess and it ought not to be impossible to embody these in specifications that both buyer and seller can accept.

To set up merely an ideal specification, which practically no producer can be expected to meet, is to invite disrespect or disregard for **all** specifications for sand and gravel.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Allentown Portland Cement Co. (common)[32]	May 24	....	1½	3	
Allentown Portland Cement Co. (6% bonds, 1932)[32]	May 24	....	87	92	
Alpha Portland Cement Co. (common)[2] new stock	July 5	No par	39	42	37½c quar. Apr. 15
Alpha Portland Cement Co. (preferred)[2]	July 5	100	115	....	1¾% quar. June 15
American Lime and Stone Co. (7% bonds, 1942)[32]	May 24	....	97	101	
Arundel Corporation (sand and gravel—new stock)	July 6	No par	35¾	35¾	50c April 1
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	July 7	....	118	120	
Atlas Portland Cement Co. (common)[2]	July 5	No par	42	44	50c qu. March 1
Atlas Portland Cement Co. (preferred)	....	100	....	....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	July 5	33⅓	43	44	2% quar. Apr. 1
Beaver Portland Cement Co. (1st Mort. 7's)[8]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (Class A)[4]	Apr. 8	....	34	34¾	75c quar. May 1
Bessemer Limestone and Cement Co. (6½% bonds)[4]	Apr. 8	....	99	100	
Boston Sand and Gravel Co. (common)	June 30	100	72	....	1% qu., 2% ex. Jan. 1
Boston Sand and Gravel Co. (preferred)	June 30	....	....	85	1¾% quar. Jan. 1
Boston Sand and Gravel Co. (1st preferred)	June 30	....	....	90	2% quar. Jan. 1
Canada Cement Co., Ltd. (common)	July 6	100	141½	142	1½% qu. July 16
Canada Cement Co., Ltd. (preferred)[11]	July 4	100	119	120½	1¾% quar. May 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	July 4	....	101	102½	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	July 4	100	95	99	
Charles Warner Co. (lime, crushed stone, sand and gravel)	June 30	No par	25½	....	50c Apr. 11
Charles Warner Co. (preferred)	June 30	100	105½	....	1¾% quar. Apr. 28
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	June 30	100	102	....	
Cleveland Stone Co. (new stock)	July 6	....	60	65	50c qu. June 15
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	July 1	100	105	....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	July 7	100	96	99	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	July 7	100	93	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	June 30	100	99	101½	
Coosa Portland Cement Co. (6% bonds, 1944)[32]	May 24	....	70	....	
Coplay Portland Cement Co. (6% bonds, 1941)[33]	May 24	....	88	....	
Dewey Portland Cement Co. (1st mort. 6's 1942)[30]	July 7	100	99	101	
Dolese and Shepard Co. (crushed stone)[7]	July 6	50	95	98	$1.50 July 1, $1 ex. July 1
Egyptian Portland Cement Co. 7% pfd.[21]	July 1	....	80	90	1¾% quar. Oct. 1
Egyptian Portland Cement Co. (common)[21]	July 1	....	5	7	40c quar. Oct. 1
Fredonia Portland Cement Co. (6½% bonds, 1940)[32]	May 24	....	97	101	
Giant Portland Cement Co. (common)[2]	July 5	50	44	55	
Giant Portland Cement Co. (preferred)[23]	July 5	50	40	45	3½% June 15
Ideal Cement Co. (common)	July 6	No par	83	84	$1 quar., $1 ex. Dec. 15
Ideal Cement Co. (preferred)[33]	July 2	100	109	111	1¾% quar. Dec. 15
International Cement Corporation (common)	July 6	No par	55⅛	55⅛	$1 quar. June 30
International Cement Corporation (preferred)[2]	July 5	100	109	109	1¾% quar. June 30
Kelley Island Lime and Transport Co.	July 6	100	140	141	$2 quar. July 1
Lawrence Portland Cement Co.[2]	July 2	100	100	104	2% quar.
Lehigh Portland Cement Co.[6]	July 6	50	107	112	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1928 to 1931)[13]	May 21	100	98	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1932 to 1935)[13]	May 21	100	96½	99	
Marblehead Lime Co. (1st Mort. 7's)[14]	July 1	100	100	....	
Marblehead Lime Co. (5½% notes)[14]	July 1	100	98	....	
Michigan Limestone and Chemical Co. (common)[6]	July 6	....	26	28	
Michigan Limestone and Chemical Co. (preferred)[6]	July 6	....	24½	26	1¾% quar. July 15
Missouri Portland Cement Co.	July 6	25	40	40½	50c May 1
Monolith Portland Cement Co. (common)[9]	June 30	....	12¼	12¾	8% ann. Jan. 2
Monolith Portland Cement Co. (units)[9]	June 30	....	30¾	31¾	
Monolith Portland Cement Co. (preferred)[9]	June 30	....	9¼	9½	
National Gypsum Co. (common)[35]	July 6	....	58½	60½	
National Gypsum Co. (preferred)[35]	July 6	....	80	85	
Nazareth Cement Co.[20]	July 1	No par	30	32	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	July 1	....	111	115	
Newaygo Portland Cement Co. (6½% bonds, 1938)[32]	May 24	....	100	102	
New England Lime Co. (Series A, preferred)[14]	July 1	100	....	95	
New England Lime Co. (Series B, preferred)[22]	June 21	100	95	97	
New England Lime Co. (V.T.C.)[22]	June 21	....	33	36	
New England Lime Co. (6s, 1935)[14]	July 1	100	99	101	
New York Trap Rock Corp. (6% bonds, 1946)[32]	June 20	....	98	98¼	
North American Cement Corp. 6½s 1940 (with warrants)	July 6	100	90½	90½	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[32]	June 30	....	62	68	2 mo. period at rate of 7%
North American Cement Corp. (common)[19]	Apr. 9	....	8⅛	9	
North American Cement Corp. (preferred)	Apr. 25	....	....	....	1.75 quar. May 2
North Shore Material Co. (1st Mort. 6's)[15]	July 7	100	98½	100	
Pacific Portland Cement Co., Consolidated[5]	June 30	100	62	74	25c mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	June 30	100	97¼	....	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	July 1	10	4⅞	5½	
Pennsylvania-Dixie Cement Corp. (1st Mort. 6's)[29]	July 6	100	99⅝	99⅞	
Pennsylvania-Dixie Cement Corp. (preferred)[28]	July 7	100	96	....	1¾% June 15
Pennsylvania-Dixie Cement Corp. (common)[28]	July 6	....	28½	28⅞	80c July 1
Petoskey Portland Cement Co.[1]	July 6	10	10½	11½	1½% quar.
Pittsfield Lime and Stone Co.[31]	Apr. 26	....	....	100	
Pittsfield Lime and Stone Co.[31] (common)	Feb. 25	....	....	25	

(CONTINUED ON PAGE 87)

[1]Quotations by Watling, Lerchen & Hayes Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [31]McIntyre & Co., New York, N. Y. [32]Hepburn & Co., New York. [33]Boettcher & Co., Denver, Colo. [34]Kidder, Peabody & Co., Boston, Mass. [35]Farnum, Winter and Co., Chicago. [36]Hanson and Hanson, New York.

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS (Continued)

Stock	Date	Par	Price bid	Price asked	Dividend Rate
Riverside Portland Cement Co.	May 9		165		
Rockland and Rockport Lime Corp. (1st preferred)[34]	July 5	100	103		3½% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (2nd preferred)[34]	July 5	100	60		3% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (common)[34]	July 5	No par	50	55	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	July 6	100	125	135	$2 qu. April 1
Santa Cruz Portland Cement Co. (bonds)[5]	June 30		105¾		6% annual
Santa Cruz Portland Cement Co. (common)[5]	June 30		85	90	$1 quar., $1 ex. Jan. 1
Schumacher Wallboard Corp. (common)	June 19		24¾	25½	
Schumacher Wallboard Corp. (preferred)	June 19		25½	25⅞	
Southwestern Portland Cement Co. (units)	May 11		205		
Superior Portland Cement, Inc. (Class A)[30]	June 30		44¾	45¼	
Superior Portland Cement, Inc. (Class B)[30]	June 30		22½		
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	June 30	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	June 30	100	98	100	
United States Gypsum Co. (common)	July 6	20	94¼	94¼	40c quar. June 30
United States Gypsum Co. (preferred)	July 6	100	122	122	1¾% quar. June 30
Universal Gypsum Co. (common)[3]	July 6	No par	5	5½	
Universal Gypsum V.T.C.[3]	July 6	No par	4½	5½	
Universal Gypsum Co. (preferred)[3]	Nov. 23		73	77	1½% Feb. 15
Universal Gypsum and Lime Co. (1st 6's, 1946)[3]	July 6	100		96	
Union Rock Co. (7% serial gold bonds)[18]	June 30		99	101	
Upper Hudson Stone Co. (1st 6's, 1951)[32]	May 24		93		
Upper Hudson Stone Co. (1st 6's, 1937)[32]	May 24		104		
Vulcanite Portland Cement Co. (7½% bonds, 1943)[32]	May 24	100	98½	101	
Whitehall Cement Mfg. Co. (common)[36]	June 30		98		
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	July 7	100	99	101	
Wolverine Portland Cement Co.	July 5	10	7⅛	7⅛	15c quar. May 16
Yosemite Portland Cement Co.	May 11		7½		

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Asbestos Corp. of Amer. (5 sh. pfd. and 5 sh. com.)[1]	June 22		$1 for the lot		
Atlanta Shope Brick and Tile Co.[1]	Nov. 24		25c		
Benedict Stone Corp. (cast-stone) (50 sh. pfd. and 390 sh. com.)[1]	Dec. 29		$400 for the lot		
Blue Stone Quarry (60 shares)[2]	Mar. 16		$10¼ for the lot		
Coplay Cement Mfg. Co. (common) (4)	Dec. 16		[illegible]		
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30		70		
Eastern Brick Corp. (7% cu. pfd.) (1)	Dec. 9	10	40c		
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c		
Edison Portland Cement Co. (common)[4]	Sept. 11	50	20c		
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)		
International Portland Cement Co., Ltd. (preferred)	Mar. 1		30	45	
Globe Phosphate Co. ($10,000 1st mtg. bonds, $169.80 per $1000 paid on prin.)	Dec. 22		$50 for the lot		
Iroquois Sand and Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17		$12 for the lot		
Knickerbocker Lime Co.x	June 22		100		
Limestone Products Corp. (150 sh. pfd., $50 par, and 150 sh. com., no par)	Dec. 22		$60 for the lot		
Missouri Portland Cement Co. (serial bonds)	Dec. 31		104¾	104¾	3¼% semi-annual
Olympic Portland Cement Co. (g)	Oct. 13			£1⅜	
Phosphate Mining Co. (1)	Nov. 24		1		
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23		$200 for the lot		
Rockport Granite Co. (1st 6's, 1934)[2]	Aug. 31		90		
Simbroco Stone Co.[2]	Apr. 20		12	12	
Southern Phosphate Corp.[6]	Sept. 15		1¼		
Tidewater Portland Cement Co. (3000 sh. com.)	Dec. 22		$6525 for the lot		
Vermont Milling Products Co. (slate granules) 22 sh. com. and 12 sh. pfd. (6)	Nov. 3		$1 for the lot		
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16		10c		

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925. (6) Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass.

Arundel Corporation Report

THE following is the annual report of the Arundel Corp., Baltimore, Md., for the calendar years 1923-26, inclusive:

COMPARATIVE BALANCE SHEET DECEMBER 31

Assets—	1926	1925
Land, buildings, machinery, equipment, etc.*	$3,716,769	$4,309,981
Investments	430,311	356,103
Cash	487,361	526,622
Accounts receivable	1,124,288	1,211,711
Notes receivable	526,923	43,648
Market securities	768,886	514,580
Sundry debtors	22,809	15,035
Accrued interest receivable		
Material and supplies	29,069	13,064
Deferred charges	351,087	37,306
Liabilities—	1926	1925
Common stock†	$4,915,556	$4,915,556
Accounts payable	264,668	305,905
Notes payable		25,000
Federal taxes	217,525	194,048
Dividends payable	319,485	442,363
Accrued expenses	10,489	5,323
Reserve for insurance	80,400	68,804
Surplus	1,649,380	1,071,050
Total (each side)	$7,457,502	$7,028,050

*After deducting $2,616,479 reserve for depreciation. †Shares of no par value whereof 495,426 shares issued for $4,954,260 less 3870.4 shares reacquired and held in the treasury $38,704.

ARUNDEL CORP.'S ANNUAL REPORT FOR CALENDAR YEARS

	1926	1925	1924	1923
Net income	†$1,776,028	$1,567,032	$1,220,971	$834,862
Providing for federal taxes	217,525	194,048	157,447	108,061
Preferred dividends			23,363	68,250
Common dividends	983,030	884,722	589,691	393,077
Balance, surplus	$ 575,473	$ 488,262	$ 450,470	$265,474
Shares of common outstanding (no par)	491,555	491,555	*98,310	*98,310
Earnings per share on common	$3.17	$2.79	$10.58	$6.70

*Shares of $50 par value. †After deducting $126,266 loss on abandonment of plant.

Oakland Paving Company Bonds Offered

HALL-LANDREGAN AND CO., Oakland, Calif., are offering at 99 and interest to yield about 6¾%, $150,000 five-year 6½% gold notes of the Oakland Paving Co., Oakland, Calif. Dated, April 15, 1927. Due, April 15, 1932.

The following information is taken from a letter of F. W. Bilger, president of the Oakland Paving Co.:

Company. The Oakland Paving Co. was incorporated in 1870 and has since been actively engaged in street and highway work, recently completing the largest paving contract ever awarded by a municipality in the state of California. Through its subsidiaries, the Oakland Building Material Co. and Canyon Gravel Co., it has become one of the largest producers and distributors of building materials in the East Bay district. The company operates five yards and plants located in the cities of Oakland and Berkeley, together with the sand and gravel plant at Niles. Through the efficient operation of its producing units and fleet of 40 motor trucks the company has been able to render exceptional service to its customers at a minimum cost. Under the direction of Frank Bilger, the company has extensively developed the quarry property it owns in Oakland.

Valuation. A certified copy of the company's balance sheet as of February 28, 1927, shows the following valuations of its property:

Real estate and quarry properties	$1,043,654.96
*Plant machinery, street and other equipment	355,895.89
	$1,399,550.85

*Depreciated value.

Earnings. Average net profit before depreciation, depletion and federal income taxes for the five years 1922 to 1926, inclusive, is $87,280.95.

Purpose of Issue. The purpose of this issue is to retire current indebtedness and to provide additional working capital for the further expansion of the company's business.

Security. These notes are a direct obligation of The Oakland Paving Co. issued under the provisions of a trust indenture executed between the company and the Central National Bank as trustee. The trust indenture provides that there shall be no dividends paid on the common stock until provision is made for sinking fund requirements. Installments shall be deposited in the hands of the trustee monthly commencing October 15, 1927, which will retire 60% of the notes by maturity. No further financing

may be entered into while these notes are outstanding.

The 50 acres of quarry land owned in fee at Broadway and McAdam street, Oakland, due to its most favorable location in the heart of the city of Oakland, toward which the metropolitan center is advancing, are very conservatively appraised by the following appraisers: A. H. Breed & Sons, Watson and Kittrelle, Maiden-Rittigstein Co., at $350,000.

Clarence B. Osborne of Los Angeles, Calif., industrial engineer, geologist and recognized authority on the value of quarry properties; has completed an independent appraisal of the quarry. His estimate shows there are still 2.500.000 cu. yd. of rock remaining for production purposes.

Management. The executive management of the company is in the hands of men who have substantial cash investments in the business and who have been responsible for its success and progress since its inception as evidenced by its financial statement.

CONSOLIDATED BALANCE SHEET. OAKLAND PAVING CO., FEBRUARY 28, 1927

After Giving Effect to the Appraisal of Quarry and Certain Other Real Estate, the Proposed Issuance of $150.000 Par Value of Five-Year, 6½% Gold Notes, and Liabilities

ASSETS	
Plant and Property Equipment:	
Quarry lands, Broadway frontage and adjacent real estate	$ 945.343.30
Yard property, and other real estate	98,311.66
	$1,043,654.96
Equipment, quarry yards, street, Canyon Gravel Co. and trucks	355,895.89
Miscellaneous accounts, contracts and advances to individuals and corporations	23,662.45
Current Assets:	
Cash and street improvement bonds	6,367.22
Notes and accounts receivable	140,442.34
Work in process and inventories	83,527.09
	$ 230,336.65
Leases—Canyon Gravel Co.	90,000.00
Good will—Oakland Building Material Co.	1.00
	$ 90,001.00
Deferred Debit Items:	
Discounts and advanced interest on mortgages, new developments and options	56,893.84
	$1,800,444.79
LIABILITIES	
Preferred capital stock, authorized and outstanding—2500 shares @ $100	$ 250,000.00
Common capital stock, authorized and outstanding—5000 shares @ $100	500,000.00
Long-term notes secured by mortgages and deeds of trust	199,050.00
Five-year 6½% gold notes	150,000.00
	$ 349,050.00
Deferred miscellaneous accounts	19,438.00
Current Liabilities:	
Notes and trade acceptances payable	79,785.79
Accounts payable	172,101.85
Less application of estimated proceeds from sale of five-year gold notes	135,000.00
Remainder—current liabilities	116,887.64
Surplus—earned	89,758.87
Arising from appreciation of assets	475,310.28
	$ 565,069.15
	$1,800,444.79

Universal Gypsum and Lime Company Annual Report

IN presenting the annual report of the Universal Gypsum and Lime Co., Chicago, Ill., President Lowell M. Palmer Jr. says: The large decrease in surplus during the year was due mainly to the payment of dividends on preferred stock amounting to $227,018, and the charging to surplus of experimental and development expense, organization expense, unamortized bond discount and similar adjustments aggregating $576,800.

On July 1, 1926, the corporation acquired the York, Penn., and Orando, Va., plants, Brooklyn waterfront property, and other assets and business of the Palmer Lime and Cement Co. in exchange for stock. The stockholders on Oct. 18, 1926, authorized an issue of $2,000,000 first mtge. 6% 20-year sinking fund gold bonds to retire the then existing bonded debt and for other corporate purposes.

The difficulty experienced in manufacturing wallboard satisfactory to the trade was mainly responsible for the corporation showing a net loss of $42,733 on the operations for the year 1926. This condition was overcome late in 1926 and the corporation is now manufacturing a light, strong core "gypsolite" completely closed-edge wallboard, for which there is a large demand.

CONSOLIDATED BALANCE SHEET, UNIVERSAL GYPSUM AND LIME CO. (DECEMBER 31, 1926)

ASSETS	
Fixed assets	*$4,529,020
Cash	385,141
Accounts receivable	†613,810
Other accounts receivable	29,648
Inventories	642,976
Temporary investments	6,115
Deferred charges to future operations	531,313
Sinking funds deposited with trustee	8,369
Leasehold rights	1,351,961
Good will, patents and patents pending	637,351
Total	$8,735,705
LIABILITIES	
7% cumulative preferred stock	$4,000,000
Common stock	‡1,416,557
8% cum. pfd. stock of the Insulex Corp.	300,000
Real estate mortgages	4,900
First mortgage 6s	1,825,000
Accounts payable	187,332
Notes payable	30,000
Accrued interest, salaries, wages, etc.	88,908
Reserve for returnable bags	42,191
Unearned royalties	5,000
Capital surplus	835,818
Total	$8,735,705

Note.—In addition to the foregoing assets and liabilities, the corporation has on deposit with trustees an amount of $404,838 to retire the undeposited bonds of the previous issue.

*After deducting $440,726 reserve for depreciation. †After deducting $11,000 for reserves for bad debts. ‡Represented by 228,637 shares no par value.

Ohio River Sand and Gravel Company Bonds Offered

A SYNDICATE headed by Townsend Scott and Son and Stein Bros. and Boyce, Baltimore, are offering at 96 and interest, to yield over 6.48%, $600,000 first (closed) mortgage 6% sinking fund gold bonds of the Ohio River Sand and Gravel Co., Wheeling, W. Va.

Dated June 1, 1927; due June 1, 1939. Redeemable all or part on any interest date at 102½ and interest upon 30 days' notice.

Sinking Fund.—Indenture provides for fixed payments to the trustee of $72,000 per annum, payable monthly, beginning July 1, 1927, for the payment of interest on this issue and for the retirement of bonds. After allowing for interest, the trustee will redeem bonds by call at 102½ if not purchasable at a lower price. This sinking fund is calculated to retire the entire issue prior to maturity.

Data from Letter of President George Vang, June 6, 1927

Company.—Incorporated in West Virginia. Was formed to purchase the property of the Ohio River Gravel Co. of West Virginia, which company has been in active operation since 1922. The latter company was organized by the consolidation of five separate companies, namely: Parkersburg (W. Va.) Sand Co., Marietta (Ohio) Sand Co., New Martinsville (W. Va.) Sand Co., Wheeling (W. Va.) Sand and Gravel Co., and Armstrong Sand Co., Wheeling, W. Va. Company is at present the largest producer and distributor of sand and gravel in the Wheeling and Parkersburg district. Company is located at various points of central distribution on the Ohio river, owning properties at Parkersburg, Wheeling, Neal Island, Padin Island, New Martinsville, Lower Sisters Island, W. Va., and Marietta, Boggs Island and Martins Ferry, Ohio, and through ownership of stock of the Belle Isle Beach Co., controls a site at Wheeling, W. Va. The floating equipment is unusually complete, including towboats, barges, dredges, etc., all of which have been maintained at high efficiency and are at present equipped to handle the business economically.

Security.—A first closed mortgage upon the entire property, consisting of real estate, plants and floating equipment appraised February 19, 1927, at a depreciated value of $2,335,824.

Earnings.—Net earnings applicable to interest and sinking fund requirements of this issue, before depreciation and federal income taxes, but after deduction of all state, city and county taxes, were as follows for years ended December 31:

1922	$155,471
1923	186,609
1924	136,175
1925	132,962
1926	161,880
Five-year average	154,616

Listing.—Application will be made to list bonds on the Baltimore Stock Exchange.

CAPITALIZATION

Preferred stock	$436,150
Common stock (no par)	10,000
Firt mortgage 6% bonds	600,000

OHIO RIVER SAND AND GRAVEL COMPANY BALANCE SHEET

(As of December 31, 1926.)

ASSETS	
Fixed Assets:	
Property—Reproductive cost new, less accrued depreciation — (Day and Zimmerman appraisal)	
Sand and gravel deposits	$1,124,500.00
Land	136,833.00
Buildings and equipment	342,533.00
Floating equipment	731,958.00
	$2,335,824.00
Current Assets:	
Cash	$ 114,659.95
Notes receivable	4,525.00
Accounts receivable	86,042.69
Inventory of material and supplies (company estimate)	40,000.00
Accrued interest and commission	205.35
	$ 245,432.99
Investments—Stocks of other companies	$ 50,000.000
Notes and accounts receivable past due	37,172.96
Less reserve for bad debts	10,000.00
	$ 27,172.96
Prepaid insurance and interest, and discount on bonds	$ 68,030.50
	$2,726,460.45
LIABILITIES	
Capitalization:	
Preferred stock	$ 436,150.00
Common stock (no par)	10,000.00
First mortgage 6% bonds	600,000.00
Notes payable—Belle Island	31,000.00
Accounts payable	40,782.11
Federal income tax current year	4,499.19
Prior years	1,388.84
Accrued interest	1.113.53
Estimated liabilities for additions to property from January 1 to date of appraisal	15,544.96
	$ 94,328.63
Capital surplus	1,585,981.82
	$2,726,460.45

Silica Sand Companies Merge

OFFICIALS of the Pennsylvania Glass Sand Co., Lewistown, Penn., have formed the Pennsylvania Glass Sand Corp. to take over the plants and properties of the present company and five other organizations in the same line. The new organization has arranged for a bond issue of $5,000,000, the proceeds to be used to complete the merger and to carry out an expansion and improvement program at the different silica properties, situated primarily in the Oriskany vein. Details of the offering will be described in the financial section of a later issue of ROCK PRODUCTS. The companies entering the merger are the Pennsylvania Glass Sand Co., Berkeley Glass Sand Co., E. F. Millard Sand Works, West Virginia and Pittsburgh White Sand Co. and the Maryland Glass Sand Co., Inc. A. J. Fink is chairman of the board of the new corporation; W. J. Woods is president, and H. P. Bridges, vice-president.

New Illinois Gravel Company

THE Rock River Sand and Gravel Co. has purchased 31 acres of gravel land two miles east of Rock Falls, Ill., and have begun business, according to the *Sterling (Ill.) Gazette.* F. A. Trager is president of the company and Wallace Limond is vice president and secretary.

Awarded Government Contract

THE Leathem D. Smith Stone Co. of Sturgeon Bay, Wis., has been awarded the contract for the stone to be used in the government construction work on the breakwaters at Muskegon and Frankfort, Mich. The contract calls for 100,000 tons, valued at a delivered price of $200,000. The stone of various kinds includes derrick stone, crushed stone and mechanically handled breakwater stone. The contracts are to be finished by the end of 1928.

The company has at its command the steamers *Fontana, Kennedy, Way* and *Andaste,* equipped with self-unloaders with which they make deliveries. In addition to this fleet, however, derrick scows towed by tug will also be used. The daily capacity of the quarry has been increased this season. Under the management of Frank Behringer, shipments are running about 30,000 tons above last year at this date.

Leathem D. Smith, president of the company, has been at Muskegon and other east shore ports this week looking after business in connection with the new contract.

Grandville, Mich., Plaster Mill to Open Soon

GRAND RAPIDS PLASTER CO. is making preparations for the laying of a new Pere Marquette siding to its Grandville, Mich., mill. The Grandville mill has been standing idle for some time and had a New York Central siding as its only railroad outlet.

It is the intention to place the mill at Grandville in readiness for immediate operation so it can be used in the early fall.

The Grandville mill when operated at capacity employs between 25 and 30 men. The mine of the company is near at hand.—*Grandville* (Mich.) *Star.*

J. W. Meaker New President of Bates Bag Company

JOHN W. MEAKER was elected president of the Bates Valve Bag Co. at a recent stockholders meeting, succeeding J. E. Cornell, resigned, Mr. Cornell and other minority stockholders having sold their interests to a syndicate composed of

John W. Meaker

the Bates family, Chicago business men and strong financial interests.

Mr. Meaker was formerly general manager and treasurer of the Cyclone Fence Co. of Waukegan, Ill., a subsidiary of the United States Steel Corp.

Superphosphate To Be Made by British Columbia Smelter

EXTENSIVE plans are being made and construction will be proceeded with immediately on a large contact process sulphuric acid plant at the Consolidated Mining and Smelting Co.'s plant at Trail, B. C. This plant will make sulphuric acid from the smelter fumes, and the first unit will cost approximately a quarter of a million dollars, according to announcement made by the management.

In conjunction with this plant an experimental phosphate fertilizer plant will be erected, using phosphate from the fields in the Crow's Nest district, where the Consolidated has located large beds. Sulphuric acid which will be made and used in this connection will reduce the sulphur dioxide in fumes to that extent and consequently will reduce smoke damage.—*Victoria* (B. C.) *Colonist.*

Good Reasons for Using Domestic Portland Cement

AN ordinance providing that only domestic portland cement be used in city work was recently considered by the Commission Council of New Orleans. A great deal of foreign cement has been used in New Orleans, as it can be bought somewhat cheaper than American made cement. L. R. Ferguson, manager of the newly opened Louisiana Portland Cement Co.'s plant at New Orleans, gave reasons why the product of his company's plant was entitled to precedence. According to the New Orleans *States,* Mr. Ferguson said:

"Our pay roll will be between $400,000 and $500,000 a year. This money will mostly be spent right here in New Orleans. We will have a force of between 130 and 150 men. These men will make this city their home and their families will be brought here. We estimate there will be an increase of 500 to 1000 people in the population. They will rent houses, buy food and clothing, pay taxes and add generally to the prosperity of New Orleans, for they are a class that a city can proudly call its citizens. Banks will feel the effect from the savings accounts these people will open, for you will find them as a class frugal as well as industrious.

"The Louisiana Portland Cement Co. has its own complete organization. We carry our own bank accounts and pay all our own bills from our local deposits.

"The Louisiana Portland Cement Co. pays to the city of New Orleans, $17,520 a year rent for the ground it occupies on the Industrial Canal, and to the Public Belt Railroad, in which the city is vitally interested, we expect to pay $35,000 a year for switching charges.

"To railroads coming to New Orleans, we will pay about $140,000 a year on two commodities which we use in the making of cement. Of this money, railroad labor receives $60,000. This, of course, has a very direct bearing on the attitude of railroads serving the city. They are most interested in bettering their service to a city which gives them steady tonnage.

"These are a few of the ways in which we want to help prosperity to increase in New Orleans—if we are permitted to do so. The action you gentlemen take, and the attitude of the general consumer, on the foreign cement must govern us to a great extent.

"Our mill has been designed for an increase of 50% capacity and the foundations for the additional machinery are already built. We hope our plans for a very early enlargement of our plant will not be frustrated."

New Concrete Brick Plant for Jefferson City, Mo.

JEFFERSON CITY, Mo., is to have a plant for the manufacture of "Haydenite" concrete brick shortly, according to the Jefferson City *Capital.* E. Englebrecht is president and E. F. Schaffner is treasurer and general manager of the company, which is known as the All-Locking Zinc Shingle Manufacturing Co. One Haydenite H-shaped concrete brick making unit will be installed to start the operations.

National Sand and Gravel Convention to Be Held in Detroit in 1928

Directors Vote to Extend Research Work and to Install a Laboratory

THE National Sand and Gravel Association held its mid-year meeting at the Palmer House, in Chicago, June 28 and June 29. At the directors' meeting on June 28, it was voted to hold the next annual convention at the Book-Cadillac hotel, in Detroit, January 4, 5 and 6, 1928. Charles H. Ray, of the Ray Sand and Gravel Co., Detroit, was chosen to be chairman of the convention committee.

These dates are Wednesday, Thursday and Friday of the week before the "Road Show," which this year is to be held in Cleveland, Ohio, instead of in Chicago, as in former years.

Representatives from other cities than Detroit were present and made an effort to secure the convention, but the directors were guided as in other years by the desires of the producers as far as they could be ascertained. The Detroit producers were a unit in requesting the convention to be held in Detroit, and there were other advantages as well which caused this city to be chosen.

At the same meeting the directors appointed a nominating committee which is to bring in its report at the annual convention. This is a slightly different procedure from that of former years and should result in some saving of time at the convention.

Research Department to Have Laboratory

The matter of greatest importance considered at this meeting was perhaps the extension of research work. Under the direction of Stanton Walker, the department of engineering and research has already proven of the greatest value, not only to the membership but the industry as a whole. Naturally, the members wish more of it and a laboratory is now to be provided to carry on research on some points that are vital to the intelligent use of sand and gravel as concrete aggregate and as a general road and building material.

Financially, the association was shown to be in the same good condition that it has been for some years past.

New Ballast Committee

At the open meeting held June 29, President Haddow reviewed the work of the directors' meeting of the previous day and called on Earl Zimmerman to explain the necessity for changes in the washed gravel ballast specification. The specification adopted at the Atlanta convention (1926) had been accepted and adopted by the railway engineers' association, but in practice it had been found unsatisfactory as regards those sections in which alternative gradings and mixtures are permitted. If followed, these sections would lead to making ballast under three specifications instead of one, which would not be satisfactory to either the gravel producer or the railroads. A new committee, of which F. D. Coppock is chairman, has been appointed by the directors to study the whole matter in connection with the railway engineers' organization.

Hugh Haddow, Jr., president, National Sand and Gravel Association

Overproduction of Sand and Gravel

Some discussion followed and then T. E. McGrath brought up the subject of overproduction, which is already an acute problem in Illinois, Indiana, Iowa and Wisconsin. Mr. McGrath estimated that there was at least 25% more plant capacity in Illinois than was needed to supply all the needs of the state with the plants producing at normal rate. As soon as certain highway work is completed, he estimated that the surplus plant capacity would be 40%. Railroads have been encouraging the building of new plants, hoping thereby to obtain more freight business. This was short-sighted policy on their part for as soon as overproduction lowered the price to where the business did not pay, the first move of the producer was to try for a lower freight rate, both to reduce delivered cost in his own territory and to expand his shipping area as much as possible.

Illinois operators were perhaps able to understand the effects of overproduction better than operators in some other states, because they had the example of the coal industry continually before them. The coal industry had been in a sad condition for years because there were too many plants. The business had to be split among so many operations that there was not sufficient volume for any one to permit a profit to be made at the prices fixed by the demands of the market. Many coal producers have been running at a loss in the hope that conditions would better themselves before they were put out of business.

The Illinois Sand and Gravel Association was alive to the dangers which would result from too many plants and was taking what steps it could through the proper sort of publicity to discourage others from entering an already overcrowded field. Mr. McGrath thought that the national association should understand the situation and do what it could to assist in the work.

Trade Papers and Overproduction

In closing, Mr. McGrath said that he thought the trade papers made the situation worse by publishing pictures of fine new plants that had been built, giving the public the idea that there must be a great deal of money in sand and gravel production and encouraging newcomers to enter the field.

Edmund Shaw, editor of ROCK PRODUCTS, was given the privilege of replying to this. He pointed out that at least 90% of the new plants described in ROCK PRODUCTS were built by companies who had been in the business a long time and who built to replace plants that were too small or out of date. The records of production, 150,000,000 tons in 1924, 170,000,000 tons in 1925 and 190,000,000 tons in 1926, showed why these new plants had been needed. Whatever might be the situation locally, the industry throughout the whole country was not "overplanted" in the way the coal industry was.

Alex W. Dann said that it might be a good idea for the companies to publish financial statements. This was a fairly common practice in some other industries and the

main purpose apparently was to keep the public informed of the costs and profits of the industry so that people would not be tempted to enter a field that was well supplied with producing facilities.

Frank Peck wanted to know how far an association could go legally in trying to prevent the building of more plants. V. P. Ahearn said that he understood that there was a Supreme Court decision which held that it was not illegal for an association to discourage further investment in the field occupied by its members. No action was taken by the meeting.

Sand and Gravel Equals Cement in Capital Invested

Luncheon was served when the discussion of overproduction was concluded. After the meal had been eaten, President Haddow introduced George E. Warren, assistant general manager of the Portland Cement Association, who spoke on some of the relations between the cement industry and the sand and gravel industry. It surprised some of his hearers when he said that the capital invested was about the same in each industry, approximately $400,000,000.

Mr. Warren said the situation of too much plant capacity to supply the market was also found in the portland cement industry. For a long time the building of new plants had kept plant capacity at an excess of 25% and no way had been found to control this.

He pointed out that all engineering industries are going through a period of change. This has been brought about by standardization, meeting of special requirements and other commercial conditions that are comparatively new. Associations have had to handle technical and semi-technical matters. So far as the Portland Cement Association was concerned, it had come to consider research as the very heart and center of its activities. The basis of the cement industry is now the facts concerning concrete. He highly commended the sand and gravel association for adopting a program of research and spoke of the co-operation between the two industries in research that might be possible.

F. R. McMillan, director of research of the Portland Cement Association, spoke of the necessity of the sand and gravel association having its own research department. "Sand and gravel has a right to a hearing in the court of public opinion," was the way he put it, and he thought it as the duty of the association to find out the essential facts about the products of its members and to place them before the public in the most favorable light.

W. E. Hart, manager of the structural research bureau of the Portland Cement Association, followed, and spoke of Stanton Walker's long connection with the Portland Cement Association which had fitted him so well to handle his present work.

Standardization Committee

The committee on standardization of products met in the afternoon. Stephen Stepanion, the chairman, reviewed the work which the committee had done up to date. He added that it was the further purpose of the committee to consider other characterstics of sand and gravel than grading, such as hardness, cleanliness and the permitted percentage of deleterious materials.

No very definite action was taken by the committee and the discussion brought out the impossibility of forming very definite grading specifications without a great deal more study and research. For example R. J. Potts of Waco, Texas, said that in his locality more attention at present was being paid to the yield of aggregates than some other characteristics, and a specification to be satisfactory to the buyers of gravel in that locality must in some way determine the yield to be expected.

A great deal of the committee's time was given to questions of definition. It was thought that certain parts of the report adopted at the last annual meeting might be misinterpreted and some changes in the text were suggested.

Southern Company Developing New Gravel Deposits

THE Southern Sand and Gravel Co. are developing gravel properties on the Atlantic and Western railway a few miles from Sanford, N. C. They have acquired a large acreage on which it is estimated that there is sufficient to supply their need for several years. The company in which New York capitalists are interested will maintain their local office in Sanford, N. C.—*Raleigh* (N. C.) *News and Observer.*

Terry and Lewis Sand and Gravel Co. Incorporates

THE Terry & Lewis Sand and Gravel Co. of Galesburg, Ill., has recently been incorporated with W. E. Terry, Sr., president, and H. F. Campbell, secretary-treasurer. The company has been installing new improvements at its pit at Gladstone.

Until the recent death of C. O. Lewis the business was run as a partnership by Mr. Terry and Mr. Lewis. It was in order to transfer partnership assets that the company incorporated.—*Galesburg* (Ill.) *Mail.*

Ready to Operate

THE new plant of the Estill Springs Sand and Gravel Co., of Nashville, Tenn., is reported by the Nashville *Banner* to be ready to operate. The plant at Estill Springs will produce 20 to 30 cars daily.

The romantic Arno river in Italy now supplies building sand for the industries of the country. Stockpiles of sand and boats for transporting it are shown in the right hand picture

Agstone Conference at St. Louis

Abstract of the Official Minutes

MEANS of stimulating the use of limestone in soil fertilization was discussed at a recent conference at the St. Louis Chamber of Commerce, attended by about 80 farmers, agricultural extension agents and soils and crop specialists from eastern Missouri. The meeting was sponsored by the chamber of commerce in co-operation with the College of Agriculture of the University of Missouri.

The conference opened with an address by C. C. Hearne, agricultural extension agent for eastern Missouri, in which he stressed the need of making limestone readily available for the farmers. This, he said, could be done by closer co-operation between the producers, railroads and farmers.

Prof. M. F. Miller, chairman of the soils department, discussed the relative value of different liming materials for agricultural use in Missouri. Prof. Miller referred to charts showing acidity and fertility of different soils and explained in detail the effect of lime upon these Missouri soils. He also compared magnesium and calcium stone and showed there is little difference in the two forms. The lime the individual company puts out is not always standard, he said, which is one thing that stands in the way of the proper spread of the use of limestone in Missouri. He pointed out that limestone offered for sale varied greatly in purity and fineness. The college recommends through all its field workers the use of 10-mesh material preferably. Four-mesh material is approved if it is cheap enough so large amounts can be applied, Prof. Miller said.

Ide P. Trotter, soils and crops specialist for southeastern Missouri, discussed the problems of the proper testing of soils and the correct limestone application, based on these tests. He pointed out the testing service offered by the college which was available to any Missouri farmer and which was there to give the farmer the right kind of advice on liming.

At noon a splendid luncheon was served by the St. Louis Chamber of Commerce. This was followed by several short talks by bankers, business men, limestone producers, railroad representatives, and others. Roy S. Rauschkolb stressed the idea that the Missouri College of Agriculture should be liberally supported so that it could continue to sponsor such constructive programs.

The conference proper was resumed. The following are abstracts from some of the principal topics under discussion.

P. F. Schowengerdt, soils extension specialist. Please remember that this lime program has been definitely under way for some time. In our experience with limestone producers and railroad agricultural agents we have found that one of the greatest needs of this program is to have a co-ordination of effort. I have a map here that shows county agricultural agents, district agricultural agents, and instructors of vocational agriculture in the state of Missouri. That group of men in Missouri is going to make the limestone movement go. The state of Missouri does not pay these men a penny, as county extension agents, to tell the farmers what they think about lime, they are out there to tell them what has been found from experimental work. These experiments prove liming properly done pays at present prices.

O. T. Coleman, soils and crops specialist for northeastern Missouri. Distribution is one of the most important features of any industry. If the commodity is bulky, heavy, and cheap, the problem is much greater, and also if that product is seasonal. Our greatest rush for limestone is in the spring and fall. Usually in the spring the roads are pretty bad, so that makes a still greater rush in the fall. It also is a loose product and is shipped in carload lots and the small farmer is kept out unless he can go in with his neighbor. What is the remedy for this? The answer is in storing. There are two ways of storing, one at the point of production, and the other at the point of consumption, or at the local point we might say where the farmers can get it when they will.

Now, as to the type of storage bin. (He discussed various types and gave some figures showing expense.) Our idea is that it does not pay to put too much into a storage bin because after the farmers become sold on the idea they will likely buy in carload lots or go in with their neighbor and get a carload.

Mr. Remley stated, during the lunch hour, that in the case of one county the amount used after they put in their bin was almost three times as much as before they put in their bin, and another county practically doubled the amount. There is no doubt but that the bin will increase the consumption in most counties. It will cost 20c to 25c per ton to unload it and then there will be some loss. The total cost of bin service has usually been about 30c to 50c per ton.

P. F. Schowengerdt. Last year our county extension agents reported they had stocked limestone in about 125 towns.

A point which comes to my mind at this time is the policy of the agricultural college regarding the use of portable pulverizers. We have them in about 150 communities. We believe that it will cost a man about as much to grind limestone on the farm as to have it delivered to his shipping point. These limestone pulverizers have helped to stimulate the use of limestone in points remote from railroad stations.

Walter B. Remley, agricultural agent, C. B. & Q. railroad. We feel that it is our duty to make lime as easily available as possible. We have to educate our general superintendents to the point where they are willing to go to bat on the proposition and loosen up leases. We do not recommend expensive bins as it adds too much to the expense. The Kirksville Chamber of Commerce, like many other civic organizations, and business men in the towns have co-operated in establishing numerous lime bins on Burlington lines in Missouri.

P. F. Schowengerdt. I have just returned from a trip to western Missouri where I talked with one county agent and told him what we were trying to do. He said, "If the railroads in Missouri can get somebody in their organizations to facilitate the securing of right-of-way leases for bins and teach local agents the freight rates on agricultural limestone, it will greatly help the lime program."

The agricultural agents from several other railroads all assured the conference of their company's willingness and desire to help the counties to secure right-of-way leases for storage bins without too great a delay or red tape.

The chairman then called upon some of the producers for their views in regard to having storage bins near where the limestone was to be used. The opinions follow:

Casper Stolle Quarry and Contracting Co. There is one thing I see about the storage here. If they do not soon start building storage bins we won't be able to supply the demand. Last year we were 200 carloads short on our order and this year we have all our place filled up.

J. C. Wilbrandt, Weldon Springs Quarry Co. Our experience has been that most of the farmers want their lime at the same time. They all want it in August and September. We try to solve that problem by telling the farmers to store the lime in the off-season. We made an arrangement with the transfer company to haul it out to the farmer on his place at 75c per ton, but when weather conditions are not good he can't even do that. You county farm agents can do a great deal of good if you will encourage the farmer to stock lime in the

off-season so he has it available when the time comes when he can use it. I believe you railroad men can do a great good by encouraging the storing of lime on your right-of-way.

T. L. Fehlig, Fehlig Construction Co. I have quite a supply of this material on hand and if there is anybody in the vicinity of St. Louis that wants to truck it themselves, I can supply it. I can make the price very agreeable.

T. J. McManus, McManus Quarries Co., Keokuk, Mo. Our company will supply at a special price of $1.00 per ton, f.o.b. Keokuk, a limited amount of good agricultural stone. This stone is well ground with 30.4% passing through a 100-mesh screen.

Wm. Rhea, Jr., Ralls county extension agent, New London, Mo. The lime bin has several advantages that will apply to all the farmers. You can store lime any time of the year you want to which is not the rush season. We have started a proposition building lime bins. The farmers build those lime bins themselves by forming a little stock company. The man that can handle carload lime I do not believe is going to handle very much lime through these storage bins because he appreciates the value of lime more than the other man and he will go ahead and use it in the carload lot.

W. W. Lewelling, Calloway county extension agent, Fulton, Mo. Only a few years ago the problem was to get farmers to believe that it would pay them to use lime, but the problem now is to get lime for the farmers that want to use it. If the farmer has to drop all his work and unload a car of lime when it comes in or pay the demurrage it is a very hard proposition. We are trying to encourage the farmers during the slack season of the year to store lime and then scatter it when they need it.

A. Gorrell, instructor of vocational agriculture, Mexico, Mo. We have already about doubled our tonnage of limestone this year over last year. Our elevator is handling the proposition now. We have several elevators handling it, but I could not say whether they have their bins on their own places or not.

P. F. Schowengerdt. As representatives of your college of agriculture, we have been pleased with this meeting. We believe that this sort of a conference has a great value. It brings together different viewpoints and experiences. The problems will be worked out co-operatively, not by any of us alone. We have sponsored three conferences of this sort in southeastern Missouri and they are now using more lime than any other section of the state.

Mr. Large, Rock Island railroad agricultural agent. It occurs to me that the season of the year when the farmer is not so busy we might make a rate to him in order to get it hauled at that time.

J. E. Bouchard. This question of reducing the freight rate at a certain time of the year might be all right, but I do not believe it would be practical.

Mr. McDowell, Frisco railroad agricultural agent. With reference to dump cars we had a little experience with them. In one county on our line there was a whole trainload of lime made up and we handled it as a special train and we were going to dump it along the right-of-way and make it very nice for the farmer, but we found out that the stuff would not slip out. I do not know whether that can be done at some other time under different weather conditions or not.

Mr. Glascock, farmer from Ralls county. I want to mention the big rocks in the limestone. I happen to live alongside of the right-of-way, which saves me a two-mile haul. The less you handle lime, the cheaper it is. If you can haul it and put it right in your spreader, that is the right way to do it. A few years ago you could order a carload of lime and get it, but nowadays you can't get it. You spoke of using hydrated lime. Some of the fellows who used it just burned their lips and their eyes out.

The conference adjourned with a vote of thanks to the St. Louis Chamber of Commerce for their hospitality.

Further Comment on the Use of Cement Slurry Filters

BELOW is given the comments of another German engineer on the efficiency of rotary filters such as are in use at the Ford Motor Co. cement mill (ROCK PRODUCTS, December 25, 1926) for reducing the moisture content of cement slurry. An earlier criticism by A. B. Helbig was published in the May 28 issue and the following by Friedrich Wecke, taken from the *Tonindustrie-Zeitung,* backs up Mr. Helbig's views—namely, that a clay-limestone slurry does not filter readily and the possible economies to be derived from a rotary filter are somewhat in doubt. The complete comment follows:

REDUCING THE WATER CONTENT OF PORTLAND CEMENT SLURRY BY FILTRATION

By Friedrich Wecke

On the basis of personal experience with rotary filters in cement plants, the author considers it his duty to amplify the criticisms made by A. B. Helbig on the use of cement slurry filters.

The rotary or drum filters used in German chemical industries are horizontal cylinders rotating about a shaft, whose surface is made up of rings connected to each other, but leaving a certain clearance. The cylinder is covered by an appropriate filter cloth. In general, rotary filters are arranged with the bottom half running inside a trough, into which the material fed at the top discharges along the sides of the cylinder. Suction is provided over three-fourths of the cylinder surface through a vacuum created inside the cylinder by means of an air pump and a hollow shaft. A scraper removes the filtered material at the edge of the trough, the surface of the cylinder being cleaned over a small distance by compressed air.

A filtering installation of this kind is very complicated, when one includes all secondary machinery such as air and slurry pump, and its added costs, such as that of the filter cloth and of the power consumed, should be taken into consideration when comparing the fuel consumption of filtered and unfiltered material.

The author obtained his experiences with drum filters in a cement plant, which was using as raw material the lime residue of a soda factory. This slurry had to be corrected by an addition of limestone to furnish the desired composition. Due to the physical properties of the soda residue, the slurry with 75 to 80% water had the consistency of an ordinary portland cement slurry with 40% water. This water content was reduced to 40% by means of a rotary filter. The mass then assumed the consistency of a wet clay, so that it could be barely scraped by the scraper and was brought to the rotary kiln by a specially protected conveyor. The extent of filtering of this slurry depended on the weather conditions. In dry weather, when the screening at the quarry yielded clean limestone, filtering was satisfactory. In rainy weather, however, a dirty limestone, i.e., a limestone with admixtures of clay, was furnished. The filtering process was greatly hindered and the slurry was led to the kiln with very high water content. Comparative filtering tests with standard portland cement slurry of limestone and clay showed the filtering action to be nil.

The foregoing shows, that rotary filters can be effective in cement plants only when the slurry contains no clayey substances. Materials which have a tendency to colloidal formation are, therefore, unsuited for filtering by means of rotary filters.

This statement is confirmed by the satisfactory results obtained by the Ford Motor Co. in filtering a cement slurry of limestone and blast furnace slag, two materials which have no colloidal tendencies. The mass does not clog in the kiln, but "falls apart like wet sand." Table 3 in the original article in ROCK PRODUCTS, December 25, 1926, also shows that the greater the tendency of the raw material to colloidal formation with water, the lower filtering capacity. G. Polysius of Dessau builds drum filters for the chemical industry, but the author has never heard of its making an effort, nor of it being a successful one, to introduce the rotary filter for handling portland cement slurry of standard properties. Colloidally combined water cannot be eliminated from a filter of this kind in continuous operation. Even in cases where part of the water in the slurry may be removed by rotary filters, computations should be made to see if evaporation of water in the kiln is not a cheaper means than the operation and maintenance of a filtering plant and the increased expense of a conveyor for a pasty mass, which is much more expensive than the gravity chute for slurry of normal consistency.

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts), as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

	Limestone Flux —Week ended—			Sand, Gravel and Stone —Week ended—		
District	May 28	June 4	June 11	May 28	June 4	June 11
Eastern	4,068	3,616	4,536	13,631	12,315	16,546
Alleg'ny	3,839	3,294	3,843	9,501	9,443	11,866
Pocahontas	709	694	543	1,164	1,230	1,319
Southern	649	662	657	13,847	13,292	13,840
N'west'n	1,840	1,815	1,543	9,110	8,705	10,683
Central Western	608	510	581	12,059	10,855	11,810
S'western	359	323	427	6,543	6,871	6,849
Total	12,072	10,914	12,130	65,855	62,269	72,913

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1926 AND 1927

	Limestone Flux		Sand, Gravel and Stone	
	1926 Period to date	1927	1926 Period to date	1927
District	June 12	June 11	June 12	June 11
Eastern	69,360	68,790	135,791	148,437
Allegheny	84,174	81,053	119,218	133,841
Pocahontas	9,139	9,108	16,512	15,841
Southern	15,598	12,564	255,053	261,108
Northwestern	28,056	29,868	98,161	114,608
Central Western	11,045	11,431	177,286	179,352
Southwestern	5,424	7,178	109,449	114.784
Total	222,796	219,992	911,470	967,971

Comparative Total Loadings 1926 and 1927

	1926	***1927***
Limestone flux	***222,796***	***219,992***
Sand, stone and gravel	***911,470***	***967,971***

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning July 3:

CENTRAL FREIGHT ASSOCIATION DOCKET

15900. To establish on **crushed stone**, carloads, Keeport, Ind., to Buck Creek, Colburn, Delphi and Lafayette, Ind., rate of 70c per net ton. Present rate—75c to Delphi and 76c to Buck Creek, Colburn and Lafayette, Ind.

15912. To establish on **crushed stone**, carloads, Holland, Ohio, to St. Johns (De Kalb county), Ind., rate of 88c per net ton. Present rate, 101c per net ton.

15916. To establish on **sand and gravel**, carloads, Blissfield and Layland, Ohio, to Zanesville, Ohio, rate of 80c per ton of 2000 lb. Present rate—90c per ton of 2000 lb.

15918. To establish on **sand and gravel**, carloads, Evansville, Ind., when originating on the E. & O. V. Ry. to Decatur, Ill. (C. I. & W. Ry.), rate of 157c per net ton. Present rate—131c per net ton.

15919. To establish on **gravel and sand**, except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, and gravel, carloads, from Wolcottville, Ind., to La Grange, Decatur and Portland, Ind., rates of 60c, 80c and 95c per net ton respectively. Present rates—63c, 88c and 101c per net ton respectively.

15921. To establish on **crushed stone**, carloads, White Sulphur, Ohio, to stations on the Penna. R. R. rates as follows:

To Penn. R. R. stations—	Present Rate	Proposed Rate
Westerville, Ohio	$ .90	$ .80
Galena, Ohio	.90	.85
Sunbury, Ohio	.90	.85
Condit, Ohio	.90	.85
Gambier, Ohio	1.10	1.00
Howard, Ohio	1.10	1.00
Danville, Ohio	1.10	1.00
Brink Haven, Ohio	1.10	1.05

15957. To cancel carload commodity rates on **sand and gravel**, carloads, as shown in Item 1835 of C. F. A. T. B. Tariff 155P, I.C.C. 1823, from points shown in Item 1835, to Duluth and St. Paul, Minn. Present rates (representative)—Group Y, 553c, Sandusky, Ohio, 517c, and Marietta, Ohio, 565c; proposed rates, classification basis.

15988. To establish rate of 140c per net ton on **sand**, all kinds, carloads, from Delhi, Cincinnati, Ohio, to St. Marys and Minster, Ohio. Present rate, 17c.

SOUTHERN FREIGHT ASSOCIATION DOCKET

34676. **Sand and gravel** from Georgetown, Ga., to Jacksonville, Lake City, Quincy and Tallahassee, Fla. Combination now applies. Proposed rates on sand and gravel, in straight or mixed carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Georgetown, Ga., to Jacksonville, Fla., 176c per net ton, based on scale used extensively in establishing rates between southeastern points, to Lake City, Fla., same as proposed to Jacksonville; to Quincy and Tallahassee, Fla., 168c per net ton, based on the carriers proposed scale, less 10% for application over trunk and short lines for actual distance.

34686. Granite or **stone**, rubble or **crushed**, from Ladds, Ga., to Havana, Fla. Combination now applies. Proposed rate on granite or stone, rubble or crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Ladds, Ga., to Havana, Fla., 224c per net ton, made on basis of the proposed Georgia joint line scale, for application over trunk and short lines.

34694. **Sand** from Ohio River and Kentucky points to Flemingsburg, Ky. It is proposed to establish reduced rate of 9c per 100 lb., on—sand, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern—from Covington, Newport, Andrews, Latonia, Wilders, Louisville and Highland Park, Ky., to Flemingsburg Jct., Ky., combination, subjected to Agt. Jones' combination tariff. It is also proposed to establish the same rate from Cincinnati, Ohio, to this point.

34702. **Stone, crushed** or broken, etc., from Anna and Krause, Ill., Cedar Bluff, Cerulean and Madisonville, Ky., to Cornith, Miss. Combination now applies. Proposed rates on—stone, crushed or broken, stone screenings or stone refuse (not ground or pulverized stone), minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, in which case actual weight shall apply, carloads—to Cornith, Miss.: From Anna, Ill., Cedar Bluff, Cerulean and Madisonville, Ky., 115c, and from Krause, Ill., 137c per net ton—made with relation to current rates to Jackson, Tenn.

34725. **Sand and gravel**, from Petersburg, Old Dominion Siding and Ellerslie, Va., to Foxes, Va. It is proposed to establish reduced rate of 79c per net ton on—sand and gravel, minimum weight 90% of marked capacity of car (except when cars are loaded to their visible capacity, the actual weight will govern), from the origins mentioned above to Foxes, Va., same as rate in effect from these points to Emporia, Va.

34726. **Sand and gravel**, from Old Dominion Siding and Ellerlie, Va., to Norfolk So. R. R., Beaufort Division, stations. It is proposed to revise the present rate of 144c per net ton on sand and gravel, carloads, from the origins mentioned to N. S. R. R., Beaufort Division, stations, Millers, N. C., to Almeta, N. C., inclusive, to be 147c per net ton, which is the rate now in effect from Richmond and Petersburg, Va. The present rates are on an improper basis.

Amendment 1 to 34632. **Sand** from Memphis, Tenn., to Blue Mountain and Ripley, Miss. Submittal No. 34632, included in Docket 371, for June 27 hearing, proposed rate of 150c per net ton on sand, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Memphis, Tenn., to Ripley, Miss. This proposition is now amended so as to provide for rate of 150c per net ton on this commodity from Memphis, Tenn., to both Ripley and Blue Mountain, Miss.

34756. **Sand, gravel, crushed stone**, etc., between points in southern territory. It is proposed to revise all rates on sand, gravel, crushed, broken and rubble stone, slag and chert, between all points in southern territory on basis of the single and joint line scales prescribed by the Interstate Commerce Commission in Docket 17517 and related cases.

34765. **Crushed stone** from Trent, Va., to stations on the L. & N. R. R., Cumberland Valley Division, and Kentucky & Virginia R. R. branch. It is proposed to revise the present rates on crushed stone, carloads, from Trent, Va., to be 68c per net ton to Page, Ky.; 86c to Wallins, Ky., and 90c per net ton to Wilhoit and Baxter, Ky., the suggested rates to be observed as maximum at intermediate points. The suggested rates are made in line with the rates established from Mullins, Ky., and Sparks Quarry, Ky., local stations on the Lebanon branch of the L. & N. R. R. to the same destinations, distance considered.

34812. **Stone** and granite, **crushed**, from Haile, Fla., to A. C. L. R. R. stations in Georgia. It is proposed to establish commodity rates on—Stone and granite, crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern—from Haile, Fla., to A. C. L. R. R. stations in Georgia on and south of the line Brunswick through Nahunta to Waycross, thence through Thomasville to and including Alaga, Ga., also stations on the A. C. L. R. R. from Thomasville to Albany, Ga., inclusive —on basis of the carriers' proposed Alabama-Georgia scale, less 10%.

34872. **Sand** from Carrollton, Ky., to Corbin, Ky. Present rate, 170c. Proposed, intrastate rate on sand, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern, from Carrollton, Ky., to Corbin, Ky., 160c per net ton, based 10c per ton over the rate from Louisville to Corbin, Ky.

34885. **Sand and gravel** from Nashville, Tenn., to Madison and Edenwold, Tenn. Extension of present rate. It is proposed to extend to December 31, 1927, the 60c per net ton rate on sand and gravel, straight or mixed carloads, from Nashville, Tenn., to Madison and Edenwold, Tenn., which is scheduled to expire June 30, 1927.

34893. **Sand and gravel** from Chattanooga, Tenn., to L. & N. R. R., Atlanta Division, stations. Class "N" rates now apply, and it is proposed to establish the following reduced rates on sand and gravel, in straight or mixed carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Chattanooga, Tenn.: To Patty, Benton and Ocoee, Tenn., 126c; Old Fort, Conasauga and Tennga, Tenn., 131c per net ton, made on basis of the proposed Georgia-Alabama scale, less 10%.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

12523. **Stone,** broken or **crushed** in bulk in gondola or other open top cars, carloads, minimum weight 90% marked capacity of car, except when cars are loaded to cubical or visible capacity, actual weight will apply, from Lenoxdale, Mass., to Taconic and Lakeville, Conn., 80c per ton of 2000 lb. Reason—To meet motor truck competition.

12527. Run of bank or screened or crushed **gravel** and common **sand,** carloads, minimum weight 90% marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from Scotia, N. Y., to Cambridge, N. Y., $1.15 per ton of 2000 lb., via B. & M. R. R., Eagle Bridge, N. Y., and D. & H. Co. Reason—To meet motor truck competition.

12538. **Stone, crushed,** carloads, minimum weight 90% marked capacity of car when moving in open cars, from East Wallingford or Middlefield (Reed's Gap Quarry), Conn., to Higganum, Conn., 70c per ton of 2000 lb. Reason—To permit of the movement of an accumulation of stone and relieve the pressure of production at other quarries.

12544. **Sand, building, common or run of bank,** carloads, minimum weight 90% marked capacity of car, from New Haven and Avon, Conn., to Mansfield, Conn., $1.60 per ton of 2000 lb., via Willimantic, C. V. Ry. Reason—To provide commodity rate same as the combination of locals.

12545. **Stone,** broken or **crushed,** in bulk or other open top cars, carloads, minimum weight 90% marked capacity of car, except when cars are loaded to cubical or visible capacity actual weight will apply, from Rocky Hill, Conn., to Mansfield, Conn., $1.40 per ton of 2000 lb., via Willimantic, Conn., Reason—To provide same rate as is now in effect from Meriden and Branford, Conn.

12557. **Stone,** broken or **crushed,** in bulk in gondola or other open top cars, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to cubical or visible capacity actual weight will apply, to Summit, R. I., from New Britain (Cook's Quarry), Conn., $1, and from Westfield, Mass., $1.10 per ton of 2000 lb. Reason—To restore relationship.

12637. Filter **sand,** carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from North Wilbraham, Mass., to Kingston, N. Y., $2.80 per ton of 2000 lb., via Selkirk Jct., N. Y., or Albany, N. Y. (or West Albany Transfer, N. Y., N. Y. C. R. R.), and West Shore R. R. to destination. Reason—To establish commodity rate comparable with rate to Wingdale, N. Y.

12644. **Agricultural lime** and limestone, burnt or unburnt, carloads, minimum weight 40,000 lb., from Winooski, Vt., to stations on Rutland R. R., via Burlington, Vt.-Rouses Point, N. Y.-Rutland R. R., rates suggested to be on comparable basis with rates now published by the Rutland R. R. from their lime shipping stations to C. V. Ry. stations. Exhibit showing representative present and proposed rates to the destinations involved will be furnished on request.) Reason—To place lime shipper at Winooski on equal basis with Rutland R. R. lime shippers.

12647. **Agricultural lime,** carloads, minimum weight 40,000 lb., from Winooski, Vt., to Oneonta, Otego, Wells Bridge, Unadilla, Sidney, Bainbridge, Afton, Neneveh, Harpursville, Tunnell, N. Y., and Center Village, East Windsor, N. Y., 15c; to Sanataria Springs, Port Crane, Binghamton, N. Y., and Windsor, N. Y., Lanesboro, Honesdale, Prompton, Waymart, Fairview, Carbondale, Mayfield, Jermyn, Archbald, Peekville, Jessup, Olyphant, Dickson, Providence, Green Ridge, Scranton, South Scranton, Minooka-Taylor, Moosic, Avoca, Pittston, Yatesville, Laflin, Hudson, Miners Hills, Parsons, Plymouth, Wilkes-Barre, Penn., 16c, via Rouses Point, D. & H. Co. Reason—On a comparable basis with rates from New Haven Jct., Vt., as it is customary to establish practically the same basis of rates on agricultural lime from Winooski, Vt., as in effect from New Haven Jct., Vt.

12652. Molding **sand,** carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Elnora, Mechanicville, Reynolds, Schagticoke, Schuylerville, Scotia, Saratoga Springs, Stillwater, Ushers and Wayville, N. Y., to Ottawa, Ont., 16c, via B. & M. R. R., Wells River, Vt., C. P. Ry., or via B. & M. R. R., White River Jct., Vt., C. V. Ry., St. Johns, Que., and C. N. Rys. Reason—To place these routes on a parity with D. & H. Co., N. J. Ry., C. P. Ry. route.

TRUNK LINE ASSOCIATION DOCKET

15557. **Stone, crushed** or quarry broken, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from Jamesville, N. Y., to Buffalo, N. Y., $1.60; Glenmount, N. Y., $1.70 and Stockport, N. Y., $1.80 per ton of 2000 lb., rates to apply as maxima from and to intermediate points. Reason—To establish rate which will be comparable with rates not in effect to Forks, North Tonawanda, Niagara Falls, Suspension Bridge, etc., as per D. L. & W. R. R. Tariff I.C.C. 20352.

15590. **Sand,** other than blast, engine, foundry, glass, molding, quartz, silica and silex, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Lewes, Del., to Bridgeville, Del., $1.15 per ton of 2000 lb. Reason—Proposed rates are comparable with rates from Lewes to Greenwood and Dover, Del., as per P. R. R. Tariff G. O. I. C. C. No. 14212.

15592. **Crushed stone,** carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Steelton, Penn., to Fern Glen and Tomhicken, Penn., $1.30 per ton of 2000 lb., to expire November 30, 1927. Reason—To revise existing rate and bring into closer alignment with existing rate from Loyal Sock, Dalmatia, White Haven and Allentown, Penn., to above points of destination, as per P. R. R. Tariff G. O. I. C. C. No. 13971 and L. V. R. R. Tariff I. C. C. No. C7856.

15593. **Sand,** other than blast, engine, foundry, glass, molding or silica, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Solsville, N. Y., to all stations on the Unadilla Valley R. R., $1.10 per ton of 2000 lb. Reason—To place the shippers at Solsville on a comparative basis with shippers at other shipping points.

WESTERN TRUNK LINE DOCKET

6122. **Sand and gravel,** carloads, minimum weight 90% of marked capacity of car, from Quincy, Ill., to Shelbina, Lakenan, Hunnewell, Monroe City, Ely, Woodland and Palmyra, Mo. (rates per net ton):

		Present		Prop.
	Miles	Sand	Gravel	Sand & Gravel
Shelbina, Mo.	46	$1.20	$2.20	$0.90
Lakenan, Mo.	41	1.20	2.20	.90
Hunnewell, Mo.	36	1.10	2.20	.85
Monroe City, Mo.	30	1.10	2.20	.80
Ely, Mo.	23	1.10	2.20	.75
Woodland, Mo.	19	1.00	2.20	.75
Palmyra, Mo.	15	1.00	2.20	.75

1376N. **Sand,** silica, pumice, volcanic ash, carloads, minimum weight 60,000 lb., from Kanopolis and Mt. Zion, Kans., also Morland, Kans., to Kansas City, Leavenworth, Atchison, St. Joseph, Council Bluffs, Omaha, Chicago, Peoria, St. Paul and Mississippi River. Present, class rates; proposed, to lower Missouri River crossings, 12c; to Omaha, 22c; to Chicago, Peoria and St. Paul, 24c; to Mississippi River, 22c; also to add Morland to Item 6140C, W. T. L. 18L, as point of origin.

Recent I. C. C. Decisions

19144. Combination rate of 33.5 cents on cement from Boyles, Ala., to New Iberia, La., unapplicable. Rate of 31 cents in accordance with Sligo Iron Store rule, 62 I. C. C. 643, found applicable. Reparation recommended.

18259. Rate of 5 cents on crushed stone and chatts shipments made in 1922 and 1923 from Webb City and Orongo Jct., Mo., to Arcadia, Kas., a distance of 45.2 to 48.9 miles, found unreasonable in that it exceeded 4 cents and reparation awarded on that basis.

17754. Rate of 1.195 on talc shipped in 1924 and 1925 from Emeryville, N. Y., to Dallas, Texas., not unreasonable and case ordered dismissed. Future rate determinations already prescribed in 123 I. C. C. 203.

I. and S. 2913. Schedules suspended until December 24, 1927. The suspended schedules propose to restrict the so-called Kelly combination rule for constructing through rates on sand and gravel, carloads, between points in southern territory so as to apply only when other tariffs employed in making a combination rate carries specific reference to the combination rule, which will result in increases.

I. and S. 2912. The schedules suspended until December 25, 1927, propose to increase the rate on crushed stone, carloads, from Gibsonburg, Maple Grove and Woodville, Ohio, to Detroit, Mich., for Pennsylvania R. R. delivery, from 80 to 95 cents per ton of 2000 lb.

13365. Sand and gravel rates from Montgomery, Ala., to LaGrange, Ga., of $1 and $1.13 per net ton in effect prior to July, 1922, found not unreasonable in that they exceeded $1 prior and 90c after July, 1922. Original award of reparation and unreasonableness reversed and report set aside.

To Investigate Southwestern Freight Schedules

AN investigation of freight rates on sand, gravel, crushed stone and shells within the Southwest has just been announced by the Interstate Commerce Commission. The investigation will be docketed as Part 11 of rate structure investigation No. 17000, with which the commission has combined certain other formal cases and petitions filed by the Louisiana Public Service Commission, the Louisiana Highway Commission and the Arkansas State Highway Commission.

The full text of the notice, which is dated June 13, follows:

No. 17000. Rate Structure Investigation, Part 11, Sand and Gravel.

No. 9702. Memphis-Southwestern Investigation (and other proceedings reopened therewith).

No. 16002. R. A. Gibson v. Kansas City Southern Railway Co. et al.

No. 18702. Tennessee Arkansas Gravel Co. v. Missouri Pacific Railroad Co.

Petition has been filed by the Louisiana Public Service Commission, the Louisiana Highway Commission, and the Arkansas State Highway Commission, asking that this commission investigate the rates on sand, gravel, crushed stone and shells, in carloads, between certain points in the Southwest.

No. 9702, Memphis-Southwestern Investigation, and cases consolidated therewith, 77 I. C. C. 473, in which the commission prescribed rates on these commodities to and between certain points in the Southwest, have been reopened for further hearing primarily for the purpose of reconsidering the rates on sand and gravel between Memphis, Tenn., and Arkansas, and between points within that state.

The commission has concluded to assign for hearing with the above proceedings No. 17000, Rate Structure Investigation, insofar as it relates to the interstate and intrastate rates under section 13 of the Interstate Commerce Act, on sand, gravel, crushed stone, shells and related commodities taking the same rates, in carloads, between points in Arkansas, Oklahoma, Texas and Louisiana west of the Mississippi river, but including both banks of the Mississippi river bordering on that part of Louisiana and Arkansas. This portion of No. 17000 will be designated Part 11, Sand and Gravel.

The filing of separate complaints or of petitions of intervention herein is not necessary. All interested parties who desire to do so may appear at the hearings and at the proper time will be heard.

The dates and places of hearings will be announced later. A proposed report will be issued.

Current Abstracts of Foreign Literature

Colloidal Silica. Dr. Luftschitz, Berlin, discusses arguments presented by Dr. Natho (Rock Products, April 30, 1927) on colloidal silica. Dr. Natho's fundamental idea is that a numerical ratio should be established between lime and silica, whenever lime or cement are combined with silica, so that "the total CaO present is transformed by the silica to a tri-silicate in the case of lime and to a 2½-silicate in the case of cement." A contradictory statement is noted: "that not only the soluble silica, but also the insoluble, quartzitic silica is effective." The latter, however, can hardly be placed into a chemically numerical relation with lime, as expressed by Dr. Natho by the ratios of $3.0CaO \cdot 1SiO_2$ or $2.5CaO \cdot 1SiO_2$ As an example, Dr. Natho quotes the case of the hydrochloric acid extract of brick dust which produces increased strength. Though this is correctly interpreted by Dr. Natho, it should be ascribed to the fact that surface changes of an admixture become apparent particularly in the tensile strength of mortar.

That silica can be effective when extracted with hydrochloric acid may be proven by a test, in which dolomitic lime was mixed with extracted silica (one-quarter of the quantity of lime) and yielded a compressive strength at 28 days of a 1:3 mortar of 113.8 kg./cm.^{2} (1615 lb./in.^{2}) while trass treated in the same manner mixed with the lime yielded but 54.4 kg./cm.^{2} (772 lb./in.^{2}). Though no numerical relations have as yet been worked out for the proportions of silica and lime, the author (Luftschitz) has obtained best results with a mono-compound of the free lime and soluble silica. It is to be noted that an increase in soluble silica is observed wherever an etching substance is present in contact with water, more especially in the presence of heat or even pressure, as in the manufacture of sand-lime brick, the energy being increased. This increase of silica in the steam boiler and the relation of lime to this new quantity of silica form the subject of extensive tests conducted by the author, whose results will be published in the near future. *Tonindustrie-Zeitung* (1927), **32**, 544-5.

Watertight Cement Roofing Tile. The waterproofness of cement tile is impaired by insufficient density of the tile, and by either a poor selection of raw materials or by flaws in the manufacturing process or both. A coarse sand with a great quantity of particles of uniform size is a poor material for this purpose. This is also true of a sand containing impurities, which become washed out in the tile forming holes which impair the watertightness of the roof.

The method of mixing the materials has an important effect on the final density of the product. Thorough mixing is as important as the selection of proper materials.

Correct proportions are of utmost importance. Sufficient aggregate should be added to prevent shrinkage and formation of cracks. On the other hand, the proportion of cement should insure complete filling of the voids. The mortar should not be leaner than 1:3½.

The danger of cracks is eliminated to a certain extent by applying a surface coat. It is an established fact that a thin coat is more effective in this respect than a thick one. Admixtures of siliceous substances, such as trass, brick dust, etc., have a beneficial effect on the resulting watertightness.

It is a positive necessity that the materials should be thoroughly compacted in the mold and that all air is forced out. Great care should, therefore, be given to the selection of tamping tools. It has been found that a tamper with small cross section is more effective than one with a large cross section. Tamping should be combined with a sliding action, which forces the mortar into such holes as may be present in the mass. Attempts were made in recent years to increase the efficiency of the tampers by installing specially designed tables. The output was thus raised to 70 tile per hour tamped by one man. While there is no doubt that this is accomplished under most favorable working conditions, it is none the less true that the short time of tamping each tile represents unusual skill and force expenditure. An increase in output by working several tile at one time is also of questionable value. The best and most uniform tile are, no doubt, produced when great care and considerable time are used.

The maintenance of tools is also to be kept in mind. If the tile are to be true to a certain profile and are to form continuous surfaces when in use, the condition of the tools is to be carefully watched.

This completes the list of causes of insufficient watertightness in cement tile roofs. While it is true that negligence on the part of the manufacturer may result in an inferior product, it is nevertheless a fact that roofs of cement tile have withstood the effects of time, weather, etc., for as long as 40 and 50 years and are still in excellent condition. *Tonindustrie-Zeitung* (1927), **42**, 745-47.

Recent Studies of the Processes Involved in Burning Powdered Materials Below the Point of Fusion. In burning cement, clay and other powdered materials great changes of the original properties are produced. These changes were first studied on metallic powders and the results successfully applied to inorganic materials.

An expansion of the particles is first produced during heating. The temperature at which this sets in is 0.3 x abs. fusion temperature for metals; 0.57 x abs. fusion temperature for inorganic salts and 0.92 x abs. temperature of fusion for organic substances. The simpler the structure of a molecule of a given substance, the lower is the temperature at which this expansion takes place. If a mixture of two substances is heated, whose reaction results in liberation of heat, the reaction sets in far below the points of fusion of both substances. In general, it occurs at the temperature at which the expansion of particles (recrystallization) begins in the substance which recrystallizes at lower temperature.

Recrystallization is a process of diffusion resulting from a displacement of the molecules. With increasing temperature, the number of displacements and the rate of displacement are increased. As these reactions depend upon displacement of molecules in a solid state, addition of water is but of little importance in this respect. In general, water accelerates these reactions.

Contrary to reactions in a liquid state, the reactions in solid state can take place only in one direction, in which heat is developed. Equilibrium is reached only at a certain temperature and only when the heat of reaction is smaller than a small calorie.

Theoretically, these reactions should have a yield of 100%. However, as the displacement per unit time and the rate of displacement are different functions, the size of particle considerably influences these changes. A considerable number of particles of one of the components heaped in one place prevents the changes from taking place. The extent of the reaction may be furthered by mixing.

Silicates belong to the group of extremely slow substances. The product of reaction forms a coating around the reacting bodies and retards the process. A short period of heating results in changes of but a few per cent of the substance. Heating a mixture of the composition of portland cement to 1100 deg. C. results in a change of about 3%. Upon pulverizing and subsequent heating 4.5% take part in the reaction. At 1400 deg. C. (partial fusion) 30% have undergone a change. The change is considerably accelerated by mixing the substance with water.

The expansion of particles of ceramic masses can be recorded by determining the compressive strength of pressed samples. Fluxing materials are also added to powdered substances. These produce sintering of the product at lower temperatures. In accordance with the foregoing, water used in the working of ceramic masses has but a secondary importance. — *Zement* (1927), 406.

Strength Variations of Portland Cement Lime Mixes. The author, Heinrich Luft-

schitz, Dresden, points out that admixtures of silica and alumina to calcium oxide result in increasingly high quality of the product. Instead of elements, we deal here with oxides. Porcelain, endowed with high tensile strength combined with low expansion, represents an ideal among non-metallic substances.

The development of the portland cement from lime, its forerunner, shows clearly a constant increase in the silica content. Even the Romans had an established practice of adding trass and other similar substances to lime. In recent years, the search for a high strength cement has resulted in a further increase of the silica content, which was found to have a favorable effect on tensile strength and soundness. Soliditite—a high strength cement—is obtained by the addition of heated quartz (sand) to ordinary portland cement. It is probable that the heating process and the resulting physical changes of the quartz benefit the tensile strength as well as the increased silica. Silica may be added before or after calcination. American portland cement has a higher percentage of silica in the raw mix than the German portland cements.

The high alumina fused cement represents the result of efforts to improve the quality of cement by increasing the alumina content. It was discovered in 1908 by the Frenchman Bied after two German scientists, Schott and Killig, had previously experimented with this subject. In recent years a cement with high alumina content, similar to the fused cement, came into use in Germany under the name of "Bauxitland" cement. It is manufactured with admixtures of bauxite, the original material, which, combined with limestone, yields fused cement. A similar patent effective in Austria covers the Kühl cement, named after its inventor. As in the case of silica, alumina may be added either before or after calcination.

Siliceous substances, which may be added to cement, form a large group. The author made parallel studies of their effect on portland cement and lime. Increased strength of portland cement due to such admixtures may be expected only when free lime is present in corresponding proportions. This beneficial chemical action is noted especially in underburned cements. It is frequently the case that admixtures are called upon not to increase the quality, but to keep certain cements suitable for definite purposes.

The author succeeded in raising both tensile and compressive strength of cement, by adding moist colloidal silica to red hot cement clinker. The tensile strength was raised from 17 (without silica) to 27 kg. per sq. cm. in a few days (from 241 to 383 lb./in.^{2}). A 50% admixture of lignite ash, a material very similar to natural trass, resulted in reducing the quality of cement to that of ordinary cement. Thurament, a slag, results in a rise of strength of cement, due to the fineness and the silica content of this material. Rhine trass, Bavarian trass and Cemolite are natural products of volcanic action. Colloidal silica is a by-product of alum manufacture and is formed during the decomposition of clay by sulfuric acid.

The beneficial action of colloidal silica on lime was studied by using the same admixtures. In certain cases the quality was improved to equal the standards of slag cements, known as standard cements. An outstanding instance was that of a dolomitic lime which had no strength under water and which was raised to 206 kg. per sq. cm. (2923 lb./in.^{2}) in a 1:3 mix.

The effect of lime admixtures to portland cement was next studied. Portland cement was mixed with 1, 2 and 3 parts by volume of lime. A reduction of quality was noted, particularly apparent in the case of hand-mixed specimens.

A comparison was made of the adherence of particles in concrete with the adherence of masonry units, to demonstrate the importance of this property, as on it is based the strength of the whole. Loam particles or other foreign matter present in the cement gel may reduce the strength to one-half of its value. Particles of aggregate coated with clay will also reduce the strength of concrete. The physical and chemical properties of materials should, therefore, be constantly kept in mind.

Aside from the physical and chemical action involved in the manufacture and use of portland cement and lime, additional processes may take place due to extraneous influences. This is the case of chimneys built with lime mortar. The smoke gases, frequently containing sulfuric anhydride, produce the formation of gypsum in the lime. This invariably results in deterioration. The effect of smoke gases is even more apparent in dolomitic limes, as magnesium sulfate is especially destructive. Therefore, in combining portland cement with lime, silica should be used which will react with the free lime. Portland cement contains no available silica for this purpose and surrounding the lime, it prevents its hardening by excluding carbon dioxide of the air, which has no part in the hardening of portland cement. An admixture of silica corrects these conditions. Mortars exposed to carbonaceous or sea waters may be improved by admixtures of silica, as both attack the lime.

Important variation of strength in mortars is due to temperature conditions. Heat results in an initial expansion with consequent contraction and resulting increased density. Heat applied to an extent passing a certain maximum results in reduced strength. While heat could be successfully used to raise the strength of concrete, this has not as yet become an established practice. Thus the opinion persists that only temperatures below freezing or below —3 deg. C. are harmful to concrete. The fact remains that even temperatures of +10 deg. C. reduce the strength of concrete. Calcium chloride used in the mixing water up to 17% at temperatures down to —7 deg. C. has proven beneficial. Twenty per cent admixtures result in supersaturation with consequent unsoundness.

In late years too much attention has been given to the compressive strength as criterion of the quality of cement. Compressive strength depends on the lime; tensile strength on silica and alumina, as shown above. The requirements should include high tensile strength and minimum subsequent expansion. If, instead of raising the lime content and producing an excess of lime in cement, admixtures of silica were used, better results would be obtained. Thus a concrete road laid with Soliditite or cement with admixtures of Thurament would have distinct advantages.

With a low or entirely combined lime content, with increased silica content and aggregates selected with a view to least expansion, besides maximum density, low porosity and minimum absorption, the ideal for road and construction concrete will be reached.—*Zement* (1927), **19**, 377-79, **20**, 401-3.

Rotary Kiln with Air Preheater. An extension to a rotary kiln is provided beyond the flame or sintering zone which acts as an air preheater and product cooler. Lifters are placed in the interior to drop the material through the air stream. Scoops at the end remove the material to a central outlet from wihch it drops down a stationary conduit for the incoming gas to a conveyor. The entire system is arranged for heat interchange. *J. H. Bentley, British Patent No.* 265,462.

Alumina Cement. Bauxite and alumina, proportioned so that the acidic and basic components are about equal, are introduced as a charge into a rotary cement kiln in which an oxidizing atmosphere is maintained. The resulting clinker is ground to produce a hydraulic cement containing about 11% of iron oxide with alumina, lime and silica. *H. S. Spackman, British Patent No.* 244,756.

Cement from Rock Phosphate. Crude rock phosphate is fused with sand, carbon or coke in an electric furnace and after the phosphorous vapors have been driven off, calculated amounts of alumina material (bauxite or clay) are added to produce a homogeneous cement mixture, which is drawn off, cooled and pulverized. *British Patent No.* 252,367.

Molded Asbestos Products. Asbestos is heated to a point just under fusion and while at this temperature is subjected to great pressure by rollers to yield a mass capable of being machined. *English Patent No.* 241,576.

Rotary Calciner for Magnesite. Magnesite is heated in a rotary kiln in a manner such that the temperature near the heat entrance is higher than that required for calcination or sufficient to dead-burn if necessary. The product is withdrawn from different zones according to the properties desired. *Austrian Patent No.* 104,404.

Requirements of Metallurgical Limestone*

Part I — Distribution and Transportation — Production Statistics —Purpose and Action of Blast-Furnace Flux—Effect of Impurities in Limestone — Factors Governing Use of Various Limestones

By Oliver Bowles†

ENORMOUS quantities of limestone are used for metallurgical purposes. Approximately 23,000,000 tons were so used in the United States in 1925 chiefly for smelting iron ores in the blast furnace. Smaller amounts are used in basic open-hearth steel manufacture, and in smelting lead, copper and antimony ores.

Most limestone producers have little knowledge of the way in which their stone is used in metallurgy. Maximum tolerances of silica, alumina, sulphur and possibly magnesium; and minimum content of calcium carbonate may be arbitrarily fixed for the guidance of the producer, but aside from these requirements little information is available to producers on the manner in which their stone is used, the office it performs in smelting or the effects of impurities. More complete knowledge of utilization would enable limestone operators to solve their production problems more intelligently.

On the other hand the metallurgist's knowledge of conditions governing limestone production is commonly quite limited. Wider information on the origin, occurrence and physical character of limestones, on quarrying processes and on methods of separation from impurities would be of undoubted advantage to the furnace operator.

In the following discussion covering both utilization and production of metallurgical limestone it is hoped that the problems of the two groups will be co-ordinated in a way that will be mutually beneficial.

The writer desires to acknowledge many helpful suggestions from S. P. Kinney, T. L. Joseph and C. H. Herty, Jr., metallurgists of the Bureau of Mines.

Distribution and Transportation of Limestone

It is a fortunate circumstance that limestone deposits are widely distributed in the United States. Every state has deposits. On account of lack of the desired chemical or physical properties, or difficulties of quarry operation or rock transportation, large tonnages of metallurgical stone are transported for long distances.

Naturally the widest development has been near the centers of the great smelting industries. Thus the eastern Ohio and western Pennsylvania quarries supply enormous quantities of limestone for the smelting districts lying in and about Cleveland, Ashtabula, Youngstown and Pittsburgh. The growth of great iron smelting industries at lake ports, such as Chicago, Cleveland and Buffalo, is due in part to cheap water transportation of the ores from the Lake Superior district, and in part to the same ease in transportation of fluxing stone. The accessibility of the iron ranges to the Great Lakes has its counterpart in a lesser degree in the development of a great limestone industry in the northern peninsula of Michigan near Alpena and Calcite, where the largest quarries in the world are now operated, producing thousands of tons of stone every day. It is noteworthy that the low cost of water haulage permits transportation for many hundreds of miles, while rail haulage for similar distances would be economically impossible.

Production Statistics

Following is a list of the chief flux-producing states with their tonnages based on 1925 figures compiled by the Bureau of Mines:

FLUXING STONE PRODUCTION IN SHORT TONS IN THE LEADING STATES

State	Short Tons
Pennsylvania	8,465,170
Michigan	6,054,270
Ohio	2,917,380
West Virginia	2,208,220
Alabama	889,840
Illinois	710,130
Colorado	355,060
Utah	207,140
All other states	1,033,290
Total	22,840,500

Purpose and Action of Blast-Furnace Flux

Most iron ores carry silica and alumina as impurities, and the addition of a basic flux such as limestone is necessary to form a slag with them.

Lime is infusible at the temperature of a blast furnace, but when it combines with the silica and alumina of the ore and the ask of the coke it forms a liquid slag which floats on the molten iron. Thus the molten iron, freed in large measure of these impurities, is tapped off from beneath while the slag is drawn off separately and removed to the slag dump.

Another purpose of the flux is to remove the sulphur from the charge, for this element is a serious impurity in iron and steel. Thus an important function of fluxes is to provide materials that have greater affinity for such an impurity than the impurity has for the iron, steel or other metals. Normally the slag removes about 85% of the sulphur entering the furnace.

Lime is regarded as a better desulphurizing agent than magnesia. Lime has a greater affinity for silica than it has for sulphur, hence it forms calcium silicates until the silica is exhausted, after which it reacts with the sulphur to form calcium sulphide. It is important, therefore, to have present an excess of lime above that required to combine with the silica. For the most effective reaction a high temperature should be maintained, for at high temperatures the slag will more completely desulphurize iron than at low temperatures. This is due to increased rates of interchange between slag and metal at the higher temperature, and to the fact that a more basic slag can be carried. Sulphur and other impurities are best removed where the slag has a high fluidity.

Some ores are associated with sufficient lime to be self-fluxing. Ores are said to be self-fluxing when the sum of the calcium and magnesium oxides is approximately equal to the sum of the silica and alumina. Such ores occur in the iron district of Birmingham, Ala. They smelt very readily as the constituents are intimately mixed.

Effect of Impurities on Fluxing Stone

The majority of blast furnaces employ about 900 lb. of flux for each long ton of pig iron produced. The amount of flux required varies with the amount and nature of the impurities in the ore and in the stone itself. The foreign elements in fluxing stone are usually the same as those in the ore for the removal of which the flux is added, namely, silica and alumina. It should be emphasized that impurities in the limestone are doubly detrimental; in the first place their presence reduces the percentage of lime and magnesia in the stone, and in the second place they require a certain share of the lime and magnesia to flux them off, as the flux must neutralize its own impurities as well as those of the ore.

"Available carbonate" is a term applied to the percentage of calcium and magnesium carbonates available for fluxing the ore after a sufficient percentage has been deducted to neutralize the impurities in the stone itself. In the average blast-furnace slag the ratio of $SiO_2+Al_2O_3$ to $CaO+MgO$ is about 1 to 1. Thus for every pound of silica and alumina present in a high calcium flux, a pound of lime is required to flux it. A

*Abstract of Information Circular 6041, June, 1927, Department of Commerce, Bureau of Mines.

†Superintendent, Nonmetallic Minerals Experiment Station, Bureau of Mines, New Brunswick, N. J. (In co-operation with Rutgers University.)

pound of lime (CaO) is derived from 1.785 lb. of limestone ($CaCO_3$). Hence if there are 4 lb. of $SiO_2+Al_2O_3$ in each 100 lb. of the stone, not only does the stone lose this 4 lb. of impurity, but also 4x1.785 lb. of pure limestone which are required to flux the impurity, that is a total of 11.14 lb., and the "available" carbonate in each 100 lb. of stone is only 88.86 lb. This may be expressed in a general formula as follows: If A = the percentage of $SiO_2+Al_2O_3$ in the stone, then the available carbonate is $100-A-1.785\,A$, or $100-2.785A$. Where a dolomite is employed it requires about 1.914 lb. of stone to give 1 lb. of the combined oxides of calcium and magnesium. Hence for a dolomite flux the general formula for determination of available carbonate becomes $100-2.914A$. Most fluxing stone used in the United States runs under 10% magnesium carbonate, and hence the conversion factor may be taken as 1.8 and the general formula $100-2.8A$.

The presence of impurities has other disadvantages. It has been noted above that a certain percentage of the oxides liberated from the carbonates in the stone unites with the silica and alumina in the stone to form a slag. It is evident that the fluxing of these materials will require fuel, therefore the fluxing of the impurities in the stone requires additional coke above that required for fluxing the silica and alumina in the ore. Extra slag requires extra coke, but there is a difference of opinion as to how much extra coke is needed. As other conditions may affect the amount of coke required for each additional pound of slag formed, it is difficult to arrive at an actual figure for the additional fuel cost when an impure stone is used. If A is the sum of silica and alumina in the stone, the slag formed from these impurities will be approximately $2A$. If it is assumed that x pounds of coke are required for each pound of slag, then the extra coke required to flux the impurities in the stone will be $2Ax$ pounds for each 100 lb. of stone. Hence, any blast-furnace operator who has determined a figure for the amount of coke required for each additional pound of slag formed can estimate closely the aditional fuel expense due to the use of impure stone. Assuming a value of y cents per ton for metallurgical coke, the extra cost of fuel on account of impurities in the stone will be

$$\frac{2Axy}{2000} \text{ or } \frac{Axy}{1000} \text{ cents for each 100 lb. of stone.}$$

For each ton of stone this will be

$$\frac{20Axy}{1000} \text{ or } \frac{Axy}{50} \text{ cents}$$

A third source of loss due to impurities in the stone is reduced furnace output. Furnace output for a given ore is in general inversely proportional to coke consumption per unit of slag, and as the extra slag requires extra coke furnace production is cut down to some extent.

If V = the price in cents of pure stone per ton, and V^1 = the price of impure stone, then, disregarding the possible reduction in furnace output and combining the two chief sources of loss, namely, the reduction in available carbonate and the extra fuel required,

$$V^1 = V\,(-.028A) - \frac{Axy}{50}$$

Substituting given values for percentages of impurities, pounds of coke per pound of slag, and value of coke per ton, a fairly definite figure may be obtained for the value of an impure stone as compared with a pure stone. If the value of an impure stone as thus calculated is lower than the actual cost at which such stone may be delivered at the furnace it would not pay to use the impure stone.

Other impurities in the stone are sulphur and phosphorus. Usually they are present in amounts so small as to be negligible. A sulphur content of less than 0.1% does no harm, and it is unusual to find more than this amount in commercial limestone. Phosphorus is usually deleterious only where the flux is used in the manufacture of Bessemer iron. Where so used the phosphorus content should be as low as possible, and should not exceed 0.01%. For other grades of iron the phosphorus content may reach 0.1% without harmful results, and a content as high as this is exceedingly rare.

The effect of magnesia in fluxing stone is an unsettled question. Some furnace men are opposed to magnesium while others use magnesian stone successfully. Dolomite is widely used as a blast furnace flux in England. As a rule, high-calcium fluxes are preferred if they are readily attainable, but the difference in action between the high-calcium and the dolomitic fluxes is so small that usually the choice is governed by other factors such as cost or percentage of impurities. For example, at some of the Alabama furnaces dolomite is preferred, not because of any preference for magnesia but because the dolomite has a lower silica content (1.25% as against 3.5% in the high-calcium stone) and also because of a greater uniformity in the composition of the dolomite. The subject of magnesia is discussed more fully in a subsequent section.

Factors Governing Use of Impure Fluxing Stone

The cost of stone delivered at the furnace commonly has a very direct bearing on the quality of stone used. This is due to the fact that an inferior stone may be used if the price is low enough. The question of quality is so intimately related to cost that the problem of purity of blast-furnace flux becomes quite complex. In order to clarify this point, it is necessary to make a distinction between impurities. In general they fall in two classes. Some, such as sulphur and phosphorus, are detrimental to the quality of the iron produced, hence the use of stone containing excessive quantities of these impurities could not be justified no matter how low the price. The other more common and abundant impurities are silica and alumina, and they are not regarded as detrimental to the iron, their chief disadvantages, as pointed out previously, being the requirement of additional limestone and coke to convert them into slag. Suppose that a relatively pure stone and an impure stone are both available, and that the impurities are of the silica-alumina type which has no detrimental effect on the iron. If the price of the impure stone is low enough to overcome the disadvantages then the impure stone may be used in preference to the pure stone. Thus at Bethlehem, Penn., a stone quarried near the furnaces, running as high as 5% silica is used extensively in preference to the low-silica stone from McAfee, N. J., because the transportation charge from McAfee is greater than the total cost of quarrying the impure stone. The quality of the ore also influences the degree of impurity permissible in the flux. Thus it would not be wise to use a flux high in silica with a high silica ore.

It is evident from the above that no definite rules can be laid down regarding the purity of a stone that may be used for flux. A stone that might be condemned in one locality, might be quite acceptable in another where the conditions were different. The direct bearing of cost on use indicates how important it is to be able to calculate even approximately the relation between percentage of impurities and price, as discussed previously. Usually the use of an impure stone can be justified only where it has the advantage of close proximity to the furnace, thus eliminating the usually heavy item of transportation expense.

Size of Stone for Blast-Furnace Flux

Fluxing stone is used in a great variety of sizes. At some furnaces the crusher run is used directly without screening. Usually the fines below ½-in. are taken out, partly because they tend to retard the draft, and partly because they usually contain more impurity than the lump stone, as sand and clay segregate in the fines. In modern quarry practice, and particularly in underground mining, there is less impurity mixed with the stone than during former years under cruder practice; therefore, on the basis of purity, fine materials may not be detrimental. A common range in size is minus 4½-in., plus ½-in., though larger sizes are often used. Maccoun* claims that all stone should pass through a 6-in. ring, as larger lumps may go unburned even to the tuyere, wasting heat, and injuring the furnace lining by corrosion. Blast-furnace troubles have been attributed in some in-

*Maccoun, A. E., "Recent Blast Furnace Advancement," Blast Furnace and Steel Plant, vol. 49, 1915, p. 67.

stances to irregularities in size of the limestone used. In general it may be stated that uniform sizing improves the working of the furnace.

Basic Open-Hearth Flux

The open-hearth process of making steel consists in melting pig iron and steel or iron scrap, and boiling the mixture generally with the addition of some very pure lump iron ore, until the carbon is reduced to the desired amount. A flux is added to the charge in the furnace mainly for the removal of phosphorus. For a phosphorus content in pig iron not exceeding 0.25%, additions of 6 to 12% limestone are considered good practice. When a pig iron with a higher phosphorus content is used as much as 17% limestone may be charged. The phosphorus is oxidized to phosphoric acid which unites with the lime to form calcium phosphate. The ability of a slag to take up phosphorus depends both on basicity and fluidity. Fluorspar (CaF_2) is added because it increases the fluidity without decreasing the basicity. It is possible, however, to have the slag too fluid for it then becomes active in attacking the dolomite lining. The more basic the slag the higher its melting point; hence, the higher its temperature the more lime it can absorb. An excessively high temperature is also destructive to a dolomite lining as it may approach the softening point of the dolomite.

Either lime or limestone may be used. When the flux is added in carbonate form the evolution of CO_2 makes the bath boil, insuring a lively reaction. Extra heat is required for calcination, but evidently no more additional heat is needed than would be required for precalcination.

In blast-furnace slag the proportion of $CaO+MgO$ to $SiO_2+Al_2O_3$ is about 1 to 1, but with basic open-hearth slag this ratio is about 2.5 to 1. Hence if A equals the sum of SiO_2 and Al_2O_3 in the fluxing stone, the bases ($CaO+MgO$) necessary to form a slag with these impurities will be $2.5A$, and the carbonates required will be $1.8\times2.5A$. The formula for determination of available carbonate is therefore $100-(1.8\times2.5\,A+A)$, or $100-5.5A$. In comparing this with the general formula for available carbonate in blast-furnace flux which reads $100-2.8\,A$, it is evident that impurities are much more detrimental in open-hearth than in blast-furnace flux. Thus a limestone with 2% impurity when used as blast-furnace flux would have an available carbonate content of 94.9%, while if used for basic open-hearth flux it would have only 89.0% available carbonate. On this account specifications for open-hearth flux usually demand a limestone with a silica content not to exceed 1% and an alumina content not exceeding 1.5%.

As the chief office of basic open-hearth flux is the removal of phosphorus, and as magnesium has a lower affinity than calcium for this element, dolomites or magnesian limestones are undesirable. The maximum permissible content of MgO is usually fixed at 5%.

Where the blast furnace is operated in connection with a steel plant the open-hearth slag may be used as blast-furnace flux, for it provides both iron and flux. It may be used up to 10% of the total ore burden.

The size of stone to be used in open-hearth steel furnaces depends to some extent on the rate of solution of the stone in the slag. Fragments of most well-consolidated limestones retain their original shapes, and are more or less firm and solid after complete calcination. Lime burners desire stone of this quality, for it gives a high percentage of lump lime. Therefore, after the limestone lumps in an open-hearth furnace are completely calcined, they may still retain their original shapes. Limestones vary greatly in the rate at which such masses of lime dissolve in the furnace charge, and obviously large masses of a slow-dissolving stone should not be used. No definite data have ever been assembled on the rate of solubility of various limestones in the open-hearth furnace.

It is noteworthy, therefore, that the adaptability of a stone for open-hearth flux depends on the rate of solution as well as on composition. A slow-dissolving stone may demand an unusually long time for the complete reaction to take place in the charge. Sometimes excessive fluorspar is added in an attempt to hasten the reaction, and this has the double disadvantage of wasting comparatively high-priced fluorspar, and of making the slag too liquid.

Use of Dolomite as Furnace Lining

Magnesite ($MgCO_3$), dolomite ($CaCO_3$, $MgCO_3$), and dolomitic limestones are used for lining basic open-hearth furnaces. Dolomite is the most common. Usually it is precalcined before it is placed in the furnace. The dolomite should be low in impurities, for if impure lining is employed its softening temperature is lowered, and it is more easily attacked by a fluid slag. The raw material is crushed, calcined, mixed with a small amount of tar or molasses, and tamped in to a depth of 1 or 2 ft. over a basic lining of fire brick. The essential requirements of a good lining are (1) refractoriness, (2) resistance to corrosion of slag or metal, (3) absence of disintegration on cooling, (4) absence of cracking on heating, (5) mechanical strength to resist molten flux, (6) low cost. For (1) and (2) there must be low percentages of silica and alumina. For (3) the magnesia content must be high. Dolomite is used in preference to magnesite on account of its much lower cost. The approximate composition of a satisfactory furnace lining is SiO_2 less than 1%; Al_2O_3 and Fe_2O_3 together less than 1.5%; $MgCO_3$ at least 35%, the remainder consisting of $CaCO_3$. Dolomite is used for patching the slag lines where scorification of the hearth is heaviest. It may be used in the uncalcined form.

(The next article Part II describes methods of producing metallurgical limestone.)

Canadian Asbestos Exports

ASBESTOS exports from Canada for the year ending April, 1927, totaled 138,596 tons valued at $8,642,048, as compared with 140,208 tons valued at $8,320,-872 in 1926. For the month of April alone exports amounted to 8767 tons valued at $565,203, as compared with 8903 tons valued at $615,192 in the same month last year.

There was considerable increase in the imports of asbestos packing which in the year ended April last totaled 213,965 lb. valued at $105,098, as compared with 178,-824 lb. valued at $86,737 in 1926.

Increase in Duty on Plate Glass Is Asked

THE Tarriff Commission of the United States has been asked by certain plate glass manufacturers to have the duty on plate glass increased 41.6%. The figure is placed from a comparison of the cost of manufacture in Belgium (which is the principal competing country) with the cost of domestic manufacture. Field agents of the commission secured the Belgian costs.

The average differential in production cost was found to be 22.52c per square foot. The weighted average duty under the tariff act of 1922 is 15.9c per square foot, and this would have to be increased by 41.6% to make the duty equal to the difference in cost of production. A hearing was held by the commission June 25.

Ceramic Society Sponsoring Foreign Tour in 1928

A SIX weeks tour in 1928 of European ceramic centers such as Stoke-on-Trent and the "Potteries," England, Delft, Holland, Meissen, Germany, Prague Czecho-Slovakia, Paris, France, is being sponsored by the American Ceramic Society. Over 6000 miles it is expected will be covered during the period of May 19 to July 5, inclusive, the scheduled dates of the trip. An interesting itinerary which includes the annual technical congress of the French Ceramic Society has been arranged. The cost of the tour, $900, includes practically all the usual expenses of transportation, meals, hotel accommodation, sight-seeing tours, visa taxes, etc.

Application for membership in the ceramic tour party should be addressed to the American Ceramic Society, 2525 N. High St., Columbus, Ohio, or to Executives' Tours, 25 Broadway, New York City.

New Construction Record Maintained

THE greatest volume of construction ever undertaken during the first six months of and year on record has been registered since the opening days of 1927, according to statistics compiled by the Associated General Contractors of America. Continuance of operations on a vigorous scale last month placed the total for the six-month period of this year 4% above the figure established during the corresponding period of 1926, which held the previous record.

The June volume shows an 8% increase over operations carried on during May. If even a moderate increase is made during July, the supremacy of 1927 as the greatest building year on record will be extended for another month.

Strong indications that the present record-breaking pace will be maintained are found in the enormous amount of contracts for future construction work that recently have been awarded. The volume of awards made in May was greater than any records for that month in any previous year. The total of awards for the five five months of 1927 exceeds by 5% the figures recorded for the corresponding period of 1926.

A scale which places the 1913 average at 100 as its basis shows the June volume of construction to have reached the 212 level. Index figures for the first five months of this year are: 129, 121, 135, 166, 197. Corresponding figures for the same months of 1926 are: 137, 117, 119, 151, 179. The index figure for volume of contracts awarded during May is 233. The May, 1926, mark was 227.—*New York Journal of Commerce.*

New Oregon Quarry

THE Oregon Rock Products Co. of Falls City, Ore., is expected to begin operations shortly, according to local papers. These report that limestone will be quarried for road material, to make agstone and to feed the lime kiln at the state penitentiary.

World's Largest Steam-Shovel Dipper

THE largest dipper ever built for a steam shovel was built recently by the Marion Steam Shovel Co., Marion, Ohio. It is a 12-yd. dipper. It weighs over 15 tons, or 30,211 lb., to be exact. The dipper is nearly 8 ft. wide, 6 ft. 6 in. long, and nearly 8 ft. high. With the bail attached and in a vertical position, the combination is over 16 ft. high. This type of dipper is equipped with a manganese steel front weighing nearly 10,000 lb. The back is a steel casting weighing over 6000 lb.

The bail, which is also a steel casting, weighs nearly 5000 lb., or equivalent to the weight of a Cadillac sedan. There is over 2700 lb. of structural steel in this dipper.

The dipper door, which opens and shuts at every dip of the dipper, weighs over 3 tons, or 6362 lb., exactly. This means that every time the shovel makes a pass, this heavy door, which is the weight of two or three Ford roadsters, opens and closes. And this mammoth piece of structural steel is actuated by a mere push of an electric button by the shovel operator or crane man.

And who would have thought there was 400 lb. or rivets required in the construction of this dipper?

This dipper is equipped with six teeth, each weighing over 400 lb.—*Marion Excavator.*

Gravel Company Adds Concrete Mixing Plant

THE Fountain Sand and Gravel Co. of Pueblo, Colo., recently installed a central concrete mixing plant. Deliveries will be made by truck to any part of Pueblo. Four grades will be made, testing in compression from 1500 lb. to 3000 lb.

Montana Lime Company Holds Unique Picnic

THE "old time" picnic given by the Elliston (Montana) Lime Co., to its employes and friends is described with considerable gusto by the Montana local papers. The whole program was arranged to recall the pioneer days of the state. At the outer gate of the fair ground a small town constable met visitors and had to be "bribed" before they could proceed. Cars were forced to detour over rocks and gopher holes, a fake murder and lynching was pulled off with much noise and shooting, and as a climax a hold up by old time road agents was staged in such a realistic manner that some of the visitors thought it to be the real thing.

Inside the grounds there were games of all sorts and an old time bar from which the thirsty were given their choice of many beverages. Fishooks, pins, buttons, pebbles, or anything else but money, were accepted by the barkeeper of the old school who frowned sternly when anyone tried to mooch a drink.

Games were played and lunch was served and addresses were made by W. T. Kuehn, the president of the company and J. H. Vorhis, superintendent.

Another Posthumous Honor for G. Washington—Pioneered in Cement Making

THE following letter to the Dallas, Tex., *News* from Dr. W. F. Cole, Waco, Tex., is proof of the fact that there is always opportunity to discover something new about the Father of His Country:

In 1890 I spent a vacation in the town of Hancock, Md. It is a village on the east bank of the Potomac, about forty miles above Harpers Ferry. It has but one long street at the foot of a mountain. About two miles above the town on the same bank of the river and at the foot of a mountain called Little Round Top, was the original cement plant in the United States, still in operation.

I became quite well acquainted with the manager, whose father had been a manager before him. The plant had been in operation for about 100 years and was of the stack form of kiln, the rotary type not being invented at that time. The elder gentleman gave me the history of the plant.

The Chesapeake and Ohio Canal was a conception of Washington, extending from the headwaters of the Potomac at Cumberland Gap to Georgetown, now a part of the city of Washington. Washington was one of the principal stockholders and a director in the company. The Chesapeake and Ohio Canal antedated the New York and Erie by several years. It was the largest public enterprise that had been conceived at that time in the United States. One of the difficulties that confronted the company was to acquire the great quantity of cement for the locks and walls of the canal, since no hydraulic cement had been manufactured in this country at that time.

The manufacture of hydraulic cement from separate materials was unknown before 1791, when such was made in England of chalk and clay in the right proportions as it is done there today. To avoid the costly importation of English cement, as all cement was made in England at that time, the Chesapeake and Ohio company had an expert come from England to supervise the manufacture for the company.

He made an exhaustive survey for proper materials suitably located for the manufacture on the line of the proposed canal. He found the materials of suitable limestone on the bank of the river at the foot of Little Round Top. The expert made no mistake, for the Little Round Top cement has not been excelled for a hundred years, and is extensively used by the Government and the cities of Baltimore and Washington. According to the story told me by the old gentleman, who was well acquainted with the history, Washington was responsible for the building of the canal and for the manufacture of cement in the United States. This history is but another example of the wonderful business judgment of the Father of His Country. According to history, stock of the Chesapeake and Ohio Canal was an important item in the inventory of the estate.

Unfortunately, the doctor winds up his otherwise interesting letter with a plea for a state cement plant operated by convict labor—an entirely irrelevant suggestion. We suggest that the cement manufacturers of Texas write the editor of the Dallas *News* and other mediums of public opinion and expression and suggest that the State of Texas take over the practice of medicine, employing recent graduates of medical schools and others, at low salaries, commensurate with humanitarianism, christian-like character of the profession—the benefit to humanity and not income being the primary consideration. Also, why not have the state engage in the grocery and drug business? We are sure every argument the good doctor applies to having the state engage in the manufacture of portland cement applies equally well to the butter and egg trade, and a thousand and one other industries in which Texans are endeavoring to make a living and pay taxes for the support of the state; which is to say largely for the support of the politicians.

Tariff Commission Discusses Fluorspar Producion

IN connection with the public hearings to be held on July 22 by the United States Tariff Commission covering domestic and foreign production cost of fluorspar, the commission has just made public a preliminary statement of facts.

The fluorspar investigation was ordered by the commission on January 8, 1926, upon application of James A. Green, Cincinnati, Ohio, and the Lundgren Stevens Co., Chicago, Ill. The commission in its statement, classified the various grades of fluorspar.

The year 1923 was selected by the commission as representative for purposes of determining production costs, and the trade was asked for their views on this subject.

The full text of a summary of the commission's statement follows:

A comparatively small region in southern Illinois and western Kentucky supplies 90% of the domestic production; and Colorado most of the remainder. During the war period production was more widespread; at that time there were 110 producers distributed through eight states. However, a decline in demand following the war and the resulting accumulation of stocks, reduced the number of producers in 1921 to about 50, of whom about 40 were in the three states mentioned. Abandonment of unsuccessful operations and integration in the industry further reduced the number of producers so that by 1925 there were only 35, of whom 31 were in Illinois, Kentucky and Colorado.

Ratio of Imports Increased

The ratio of imports for consumption to domestic output of fluorspar measured quantitatively, was about 38% in 1911 and gradually decreased to about 5% in 1918 and 1919. Since 1919 the ratio has increased, reaching 60% in 1926. Prior to 1923, imports came principally from England. Since 1922, although England has continued to be the principal source of imports, supplies from other countries have grown in importance.

Of the total imports of fluorspar during 1925 and 1926, 68% was metallurgical gravel, 30% was lump spar, and 1% was ground spar. England supplied 41% of the total. Ninety per cent of the imports from England was metallurgical gravel, and 10% lump spar. No ground spar was imported from England.

If imports of fluorspar be segregated for tariff purposes into grades, the basis of classification being either size of particle or value per ton.

Statistics of exports of fluorspar from the United States are not separately shown by the reports of the Department of Commerce.

The figures in the following table were compiled by the Bureau of Mines from reports of producers. For the four years shown, the quantity of exports is about one per cent of domestic production:

Fluorspar: Exports from the United States, 1922 to 1925 (short tons):

	Quantity	Value	Value per ton
1922	2,296	$40,966	$17.84
1923	1,144	25,312	22.13
1924	617	14,489	23.48
1925	1,055	17,547	16.66
1926	2,132	34,915	16.38

With the exception of 30 tons shipped in 1925 to Mexico, Canada was the destination of all exports of fluorspar in 1922-1925. The destination of exports in 1926 is not yet available.

Consumption of fluorspar in the United States has gained rapidly since 1899, when the advantages of fluorspar over lime as a flux in steel plants was first generally recognized. Before that time its chief uses were in the manufacture of hydrofluoric acid and opalescent glassware, and the demand was small.

The cost data obtained by the Tariff Commission in 1926 for the calendar year 1925 covered 86% of the total domestic production, and apply to the mines and mills of the Kentucky-Illinois district, which yields annually about 90% of the fluorspar produced in the United States.

The various operations involved in production are mining, waste sorting, lump spar sorting, concentrating, and grinding. The cost of production of ground fluorspar comprises the cost of the selected lump or gravel and the cost of grinding it.

Accounting practice in the fluorspar industry is fairly uniform and without exception provides for the segregation of all charges for both direct and indirect labor. For some companies it was necessary to make minor allocations on the basis of time distribution to different stages in the process where detailed cost distributions were not available. Costs for labor are higher for Illinois producers than for Kentucky producers.

All domestic fluorspar reaching the principal consuming points originates along the Illinois-Kentucky border.

Both domestic and imported spar are sold in lump form to acid manufacturers; the largest consumers report that they are unable to obtain sufficient supplies from domestic sources—a statement that is confirmed by domestic producers.

The distribution of acid grade spar to markets takes into account the imported and domestic lump spar sold to acid makers, and also about 4300 tons of domestic gravel and ground spar, some of which was below the standard acid grade but was sold to acid makers.—*United States Daily.*

California Lime Company Builds Hydrating Plant

THE Union Lime Co. has built a 50-ton hydrating plant at its plant at Tehachapi, Calif. The Schulthess hydrator was used and the machinery for the plant was installed by the McCann Manufacturing Co., according to the *Los Angeles Times.*

Hoosac Valley Lime Corp. Is Pushing Expansion

THE enlargement of the North Adams, Mass., plant of the Hoosac Valley Lime Corp. is being pushed to completion, according to a report in a local newspaper. Three concrete silos, two of which are 50 ft. high and the other 70 ft., which are to be used for storage of raw crushed limestone, have already been erected. Three other silos, similar to these, are now in the process of building and will be used for lime storage. All the silos were put up by the Burrell Engineering and Construction Co., Chicago.

The manufacturing equipment to be installed includes two oil-fired rotary lime kilns placed in the rear of the storage silos. Production is expected to begin sometime in the fall of this year.

The Hoosac company is a subsidiary of the Rockland-Rockport Lime Corp., which operates other lime plants at Rockland, Rockport and Thomaston, Maine.

Protests the Building of Sand Bunkers

CITIZENS of Colma, Calif., have protested the building of bunkers, or distributing bins, by the River Sand and Gravel Co. in their town on the ground that the bins would create dust and make industrial property out of land wanted for home sites.

State Gravel Co. of Seattle Reported Sold

THE State Gravel Co., of Seattle, Wash., is reported sold to John W. Heffernan of Seattle for a consideration of nearly $500,000. The *Seattle Times* in which the report is printed says of the property:

"The property, near Steilacoom, consists of 350 acres of fine quality gravel, said to be the largest single deposit of commercial gravel in the state. It is approximately 250 feet deep and the quantity is estimated at 80,000,000 yards and will last about eighty years. Equipment of the plant is said to be one of the most complete in the northwest and represents an investment of $130,000.

"The plant will be continued in operation at full capacity."

Rock Company Gives Barbecue to Its Friends

THE Union Rock Co. of Los Angeles, Calif., recently gave a barbecue to 5000 of its friends.

The affair was under the direction of George A. Rogers, president, and W. J. Van Valkenburgh, sales manager of the company. The guests were welcomed by President Rogers in an impromptu speech beginning the program.

Mining-Quarrying Industry Stages Big Safety Contest

WINNERS of the National Safety Competition, in which more than 250 mines and quarries in 30 states participated in 1926, were announced June 28 by the United States Bureau of Mines, Department of Commerce. The winning mines and quarries in this nation-wide industrial safety contest, held annually under the auspices of the Bureau of Mines, are presented with the bronze trophy, "Sentinels of Safety," donated by the *Explosives Engineer.*

Notable accomplishments in the production of large mineral tonnages with no loss of time occasioned by accidents were revealed by the detailed statistical reports furnished the bureau by the competing companies. A zinc and lead mine in Kansas operated 300 days and worked 206,489 man-hours without an accident involving loss of an employe's time. A Missouri zinc mine and 14 large quarries, located in West Virginia, Pennsylvania, Alabama, Indiana, Ohio, Kansas, California, Virginia and Michigan, also operated through the year with no loss of time due to personal injuries. The competition was one of the largest industrial safety contests ever held, and involved the tabulation of all accidents occurring during the course of 95,000,000 man-hours of labor. It required the preparation of accident statistic reports on a uniform, detailed basis which allows a more exhaustive study of the causes of accidents than has heretofore been possible. An encouraging feature of the competition was a substantial reduction in the accident rates of the winning companies in 1926 as compared with the previous year's contest.

Secretary Hoover of the Department of Commerce, in addressing congratulatory letters to the winning mines and quarries, emphasized the importance of the American mining industry attaining world leadership in accident prevention as it has already attained such leadership in the production of mineral tonnages.

The more than 250 mines and quarries participating in the competition were divided into five groups: anthracite mines, bituminous coal mines, metal mines, mines producing non-metallic minerals, and quarries or open pit mines. A replica of the trophy is awarded to the mining operation in each group sustaining the smallest loss of time from accidents in proportion to total time worked during the year. Determination of the winners was made by a jury of award comprised of officials of various mining and quarrying associations, the National Safety Council and the American Federation of Labor, based on a taubulation of mine accident data prepared by the Bureau of Mines. A feature of the competition is the awarding of a certificate of honor, signed by the director of the Bureau of Mines, to every employe of each of the winning mines and quarries for their share in the low accident records made by their companies.

In the group of underground mines producing non-metallic minerals, the trophy was awarded to the Grand Rapids gypsum mine of the Beaver Products Co., at Grand Rapids, Mich. Honorable mention was given the Ft. Dodge gypsum mine of the United States Gypsum Co., at Ft. Dodge, Iowa; the Manheim No. 5 cement rock mine of the Alpha Portland Cement Co., at Manheim, W. Va.; the Crystal City sand mine of the Pittsburgh Plate Glass Co., at Crystal City, Mo., and the Templeton limestone mine of the Templeton Limestone Co., at Templeton, Penn.

In the quarry and open pit mine group, the trophy was awarded to the No. 5 and 6 limestone quarry of the North American Cement Corp., at Martinsburg, W. Va. Honorable mention was according the following named quarries:

West Coplay limestone quarry of the Lehigh Portland Cement Co., West Coplay, Penn.
Birmingham limestone quarry of the Lehigh Portland Cement Co., Birmingham, Ala.
Louisville cement rock quarry of the Louisville Cement Co., Speed, Ind.
United States Gypsum Co. limestone quarry, Genoa, Ohio.
Kansas Portland Cement Co. limestone and shale quarry, Bonner Springs, Kan.
Ash Grove Lime and Portland Cement Co. limestone and shale quarry, Chanute, Kan.
Mitchell limestone quarry of the Lehigh Lime Co., Mitchell, Ind.
Cowell Portland Cement Co. limestone quarry, Cowell, Calif.
No. 1 and 2 high calcium limestone quarry of the M. J. Grove Lime Co., Stephens City, Va.
Dexter Portland Cement Co. cement rock quarry, Nazareth, Penn.
Royal Blue Slate Co. roofing and electrical slate quarry, Slatedale, Penn.
Monroe, Mich., limestone quarry of the France Stone Co., Monroe, Mich.
Bellevue cement rock quarry of the Alpha Portland Cement Co., Bellevue, Mich.

Members of the jury of award were as follows:

H. Foster Bain, secretary, American Institute of Mining and Metallurgical Engineers, New York.
James F. Callbreath, secretary, American Mining Congress, Washington, D. C.
W. H. Cameron, managing director, National Safety Council, Chicago, Ill.
H. L. Gandy, secretary, National Coal Association, Washington, D. C.
A. T. Goldbeck, director, engineering bureau, National Crushed Stone Association, Washington, D. C.
William Green, president, American Federation of Labor, Washington, D. C.
A. J. R. Curtis, assistant to general manager, Portland Cement Association, Chicago, Ill.

The following congratulatory letter was addressed by Secretary Hoover to the winner in each group:

"The excellent safety record established by your company at one of its plants during the year 1926, as shown by the results of the National Safety Competition held under the auspices of the Bureau of Mines, is a matter for congratulation to your company and of encouragement to all persons interested in safety in the mineral industry. It is such work as is being done by your company and others that affords the best hope that the United States may lead the world in mine safety as it is already leading in mineral production. Our aim should be for progressively lower accident rates.

"The success of your efforts in safety work during the past year entitles your company to receive the 'Sentinels of Safety' trophy which is awarded to the leaders in the National Safety Competition. Also, since the prevention of accidents is dependent not only on the operators that produce our coal, iron, stone and other minerals, but also on each employe of the mine or quarry, the Bureau of Mines will issue a Certificate of Honor to each man employed by your company in 1926 at the plant whose safety record is recognized by the award of the trophy."

Safety Organization for the Quarrying Industry

THE National Safety Council has recently published in pamphlet form a summary of the essentials of organizing for accident prevention. This bulletin was compiled jointly by the quarry section, National Safety Council and the safety committee, National Crushed Stone Association, and is available upon request to the secretary of the National Safety Council, 108 East Ohio street, Chicago, Ill.

The pamphlet contains valuable data for the quarry or mill just starting to organize for accident prevention. Ten important steps which the operator must take are outlined in chronological order. These are based on 12 years of experience in safety work of the 4300 members of the safety council. These steps are:

a. Co-operation of manager.
b. Co-operation of superintendent.
c. Appointment of safety engineer
d. Meeting of operating executives.
e. Analysis of accident records.
f. Plant inspection.
g. Mechanical safeguarding.
h. General announcement.
i. Educational program.
j. Engineering revision.

For the industry that has already started safety work this pamphlet will serve as a check list to help secure an effective and well-rounded program of accident prevention activities.

The council also has available a complete series of pamphlets on safety which are bound in attractive covers which may be had from the headquarters office.

New Quarry Near Atlanta, Ga.

A NEW granite quarry has been opened at Elberton, Ga., which is 12 miles from Atlanta, by the Elberton Quarries, Inc. The output of the quarry will be principally paving block and dimension stone, but some crushed stone will be made.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	....	1.60	1.30	1.30	1.30
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Danbury, Conn.	2.25	2.25	2.00	1.75	1.50	....
Dundas, Ont.	3.04	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.20@1.30	1.15@1.25	1.10@1.15	1.10@1.15	1.05@1.10
Munns, N. Y.	1.00	1.50	1.50	1.40	1.25	....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	....
Walford, Penn.	....	....	1.35h	1.35h	1.35h	1.35h
Watertown, N. Y.	1.00	....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Afton, Mich.	....	....	....	.75	.75	1.50
Alton, Ill.	1.85	....	1.85	....	....	....
Buffalo and Linwood, Iowa	1.10	....	1.45	1.25	1.30	1.30
Chasco, Ill.	1.00@1.30	....	1.00@1.15	....	1.00@1.15	....
Columbia, Krause, Valmeyer, Ill.	1.10@1.50	1.10@1.25	1.20@1.35	1.10@1.35	1.10@1.35	‖1.25
Flux (Valmeyer)	1.10@1.50	....	....	1.75	....	1.75
Greencastle, Ind.	1.25	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Linwood, Iowa	.95e	....	1.50[1]	1.40[2]	1.30[3]	....
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
Milltown, Ind.	....	.90@1.00	1.00@1.10	.90@1.00	.85@ .90	.85@ .90
Mt. Vernon, Ill.	1.10@1.20	1.00	1.00	1.00	1.00	....
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	1.10
Stone City, Iowa	....	....	1.20	1.10	1.00	....
St. Vincent de Paul, Que. (A)	....	1.35	.95	.85	.80	1.25
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Ont.	1.55	2.05	2.05c	1.90	1.90	1.90
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
Wisconsin Points	.50	....	1.00	.90	.90	....
Youngstown, Ohio	.70j	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h
SOUTHERN:						
Alderson, W. Va.	.40	1.45	1.35	1.25	1.20	....
Atlas, Ky.	.50	1.00	1.00	1.00	1.00	1.00
Brooksville, Fla.	.75	....	2.65	2.65	2.40	2.00
Cartersville, Ga.	1.15	1.65	1.65	1.40	1.15	....
Chico, Tex.	1.00	1.35	1.25	1.20	1.10	1.00
El Paso, Tex.	1.00	1.00	1.00	1.00	1.00	....
Ft. Springs, W. Va.	.50	1.35	1.35	1.20	1.20	....
Graystone, Ala.			Crusher run, screened, $1 per ton			
Kendrick and Santos, Fla.			3½ in. and less, $1 per ton			
Ladds, Ga.	....	1.65	1.65	1.35	1.15	1.15
New Braunfels, Tex.	.60	1.25	1.10	.90	.90	.90
Rocky Point, Va.	.50@ .75	1.40@1.60	1.30@1.40	1.15@1.25	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kan.	.50	1.90	1.90	1.90	1.90	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Kansas City, Mo.	1.00	1.60	1.60	1.60	1.60	1.60
Cape Girardeau, Mo.	1.25	....	1.25	1.25	1.00	....
Rock Hill, St. Louis Co., Mo.	1.45	1.45	1.45	1.35	1.35	1.35

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	....
Duluth, Minn.	.90	2.25	1.75	1.55	1.35	1.25
Dwight, Calif.	1.00	1.00	1.00	.90	.90	....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	*1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Tex.	2.50	2.25	1.55	1.25	1.10	....
New Haven, New Britain, Meriden and Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.40	1.80	1.80	1.40	1.40	1.40
Oakland and El Cerito, Calif.	1.00	1.00	1.00	.90	.90	....
Richmond, Calif.	.75	....	1.00	1.00	1.00	....
San Diego, Calif.	.50@ .75	1.25@1.50	1.25@1.50	1.10@1.25	1.10@1.25	....
Springfield, N. J.	1.70	2.20	2.10	1.70	1.60	1.60
Toronto, Ont.	....	3.58@4.05	3.05@3.80	....	....	....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	....
Columbia, S. C.—Granite	....	2.00	1.75	1.75	1.60	....
Eastern Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.			Crushed flint rock, 2.50 per cu. yd.			
Graystone, Ala.—Granite	.50	....	....	....	....	....
Lithonia, Ga.	.75a	1.75b	1.60	1.40	1.35	....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	....
Middlebrook, Mo.	3.00@3.50	....	2.00@2.25	2.00@2.25	....	1.25@3.00
Richmond, Calif.—Quartzite	.75	....	1.00	1.00	1.00	....
Rochester, N. Y.			Dolomite, all sizes, $1.50 per ton			
Somerset, Penn. (sand-rock)			1.50 to 1.85			
Toccoa, Ga.—Granite	.50	1.35	1.35	1.30	1.25	1.25

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ⅛ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (f) ¾ in. (h) Less 10c discount. (j) Less 10% net ton. (l) Less .05. (e) Agstone to June 15, 1927. [1] ¾ to ¼ in. [2] 1 to ¼ in. [3] 1½ to ¼ in. (A) Plus 4% sales tax, less 2% discount 30 days.

Agricultural Limestone

(Pulverized)

Alderson, W. Va. — Analysis, 90% $CaCO_3$; 50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	4.50
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Branchton, Penn. — 100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh	5.00
Brandon and Middlebury, Vt. — Pulverized, burlap bags, 6.00; paper, $5.00; bulk	4.00
Cape Girardeau, Mo.—50% thru 50-mesh	1.50
Cartersville, Ga.—50% thru 50-mesh	1.50
Charleston, W. Va.—Marl, per ton, bulk	3.00
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Tex.—50% thru 50 mesh, 1.75; 50% thru 100 mesh	2.25
Colton, Calif.—Analysis, 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Ft. Springs, W. Va.—50% thru 4 mesh	1.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$; 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Hot Springs and Greensboro, N. C.—Analysis, $CaCO_3$, 98-99%; $MgCO_3$, 42%; pulverized; 67% thru 200 mesh; bags	3.95
Bulk	2.70
(Paving dust)—80% thru 200 mesh, bags	4.25@ 4.75
Bulk	3.00@ 3.50
Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.25; bulk	2.75
Joliet, Ill.—Analysis, 52% $CaCO_3$; 44% $MgCO_3$; 90% thru 100 mesh	3.50
Knoxville, Tenn.—80% thru 100 mesh, bags, 3.95; bulk	2.70
80% thru 200 mesh, bags, 4.25; bulk	3.00
Ladds, Ga.—Analysis, $CaCO_3$, 64%; $MgCO_3$, 32%; pulverized; 50% thru 50 mesh	1.50@ 2.75
Marblehead, Ohio — Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marlbrook, Va.—Analysis, 80% $CaCO_3$; 10% $MgCO_3$; bulk, 1.50; bags	3.00
Marl—Analysis, 90% $CaCO_3$; 10% $MgCO_3$; bulk, 2:25; bags	4.00
Marion, Va. — Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Middlebury, Vt. — $CaCO_3$, 99.05%; 50% thru 200 mesh; sacked	5.00@ 6.00
Milltown, Ind. — Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Syracuse, N. Y. — Analysis 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio—30% thru 50 mesh	2.25
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass. — Analysis, 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis, 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—90% thru 4 mesh	1.00
Bedford, Ind. — Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 95% thru 10 mesh	1.50

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50
Chicago, Ill. — 50% thru 100 mesh; 90% thru 4 mesh	.80
Columbia, Krause, Valmeyer, Ill. — Analysis, 90% $CaCO_3$; 100% thru 4 mesh	1.10@ 1.50
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Danbury, Conn.—Analysis, 79% $CaCO_3$, 11% $MgCO_3$; 60% thru 100 mesh; 80% thru 50 mesh; 100% thru 4 mesh; bags, 4.25; bulk	3.25
Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh	1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Kansas City, Mo. — 50% thru 100 mesh	1.00
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92¼ $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@ 2.35
McCook, Ill.—90% thru 4 mesh	.90
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 100% thru 4 mesh; 20% thru 100 mesh	1.50
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Mountville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh, bags	5.50
Pixley, Mo. — Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich. — Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa — Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	1.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh	2.30

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Joliet, Ill.—Analysis, 54% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh; bulk	*3.50
Piqua, Ohio, sacks, 4.50@5.00; bulk	3.00@ 3.50
Rocky Point, Va.—92% thru 100, mesh, bulk	2.25@ 3.50
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

*Bags extra.

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W. Va.	2.00@ 2.25
Buffalo, N. Y.	2.00@ 2.50
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Estill Springs and Sewanee, Tenn.	1.50
Franklin, Penn.	2.25
Gray Summit and Klondike, Mo.	1.75@ 2.00
Klondike, Mo.	2.00
Los Angeles, Calif.—Washed	5.00
Mapleton Depot, Penn.	2.00@ 2.25
Massillon, Ohio	3.00
Mendota, Va.	2.25@ 2.50
Michigan City, Ind.	.35
Mineral Ridge and Ohlton, Ohio	2.50
Oceanside, Calif.	3.00
Ohlton, Ohio	2.50
Pittsburgh, Penn.	3.00@ 4.00
Ridgway, Penn.	2.50
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.00
San Francisco, Calif.	4.00@ 5.00
Silica, Va.	2.50
St. Louis, Mo.	2.00
Sewanee, Tenn.	1.50
Thayers, Penn.	2.50
Zanesville, Ohio	2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio	...	1.75
Columbus, Ohio	...	.15@ .30
Dresden, Ohio	...	1.00@ 1.25
Eau Claire, Wis.	4.25	...

*Ground silica, carload.

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.65	.65	.65	.65	.65	.65
Boston, Mass.‡	1.40	1.40	2.25	...	2.25	2.25
Buffalo, N. Y.	1.10	.95	.85	...	...	...
Erie, Penn.	...	1.00*	...	1.50*	1.75*	...
Leeds Junction, Me.	...	.50	1.75	...	1.25	1.00c
Machias Jct., N. Y.	.75	.75	.85	.75	.75	.75
Montoursville, Penn.	1.00	.85	.75	.75	.60	.60
Northern New Jersey	.50	.50	1.25	...	1.25	1.25
Portland, Me.	...	1.00	2.25	...	2.00	...
Shining Point, Penn.	...	...	1.00	1.00	1.00	1.00
Somerset, Penn.	...	2.00	...	...	...	...
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.85	.85	1.70	1.50	1.30	1.30
York, Penn.	1.10	1.00	...	...	...	...
CENTRAL:						
Aurora, Ill.	...	.40@ .50	.40	.50	.70	.70
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.	...	.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Barton, Wis.	...	.50	.75	.75	.75	.75
Chicago district, Ill.	.70	.55	.55	.60	.60	.60
Columbus, Ohio¶		.75	.75	.75	.75	...
Des Moines, Iowa	.40	.40	1.40	1.40	1.40	1.40
Eau Claire and Chippewa Falls, Wis.	...	.40	.65@1.00	1.00	.90	...
Elkhart Lake, Wis.	.45	.30	.40	.50	.50	.50
Ferrysburg, Mich.	...	.50@ .80	.60@1.00	.60@1.00	...	.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Grand Haven, Mich.	...	.60@ .80	.70@ .90	.70@ .90	...	.70@ .90
Grand Rapids, Mich.	...	.50	...	.80	.80	.70
Hamilton, Ohio	1.00	1.00	1.00	1.00	1.00	...
Hersey, Mich.	...	.50	...	.70	...	.75
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60	...	.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50@ .60	.50@ .60	1.30	1.30	1.20	1.20
Mankato, Minn.	...	...	...	1.25	1.25	1.25
Mattoon, Ill.			.75@.85 all sizes			
Milwaukee, Wis.	.96	.91	1.06	1.06	1.06	1.06
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.40@ .50	.40@ .50	1.40	1.35	1.25	...
Pittsburgh, Penn.	1.25	1.25	.85	.85	.85	.85
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	1.20	1.45	1.55a	1.45	1.45	1.45
Terre Haute, Ind.	.75	.60	.75	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.	...	.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.25	1.25
Zanesville, Ohio	...	.60	.50	.60	.80	...
SOUTHERN:						
Charleston, W. Va.	1.40	1.40	1.40	1.40	1.40	1.40
Brewster, Fla.	.35@ .45	...	2.25	...	...	...
Brookhaven, Miss.	1.25	.70	1.25	1.00	.70	.70
Chattahoochie River, Fla.	...	.70	...	1.75	...	...
Eustis, Fla.		.50				
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Knoxville, Tenn.	1.00	1.20	1.20	1.20	1.20	1.20
Macon, Ga.	...	.50	...	...	.90	.90
New Martinsville, W. Va.	1.00	.90@1.00	...	1.20@1.30	...	.80@ .90
Roseland, La.	.35	.25	1.25	1.25	.50	.50
WESTERN:						
Kansas City, Mo.	...	.70	...	...	...	...
Los Angeles, Calif.	.40	.40	.25@1.00	.25@1.00	.25@1.00	.25@1.00
Oregon City, Ore.	...	1.25*	1.25*	1.25*	1.25*	1.25*
Phoenix, Ariz.	1.25	1.10	2.50	2.00	1.25	1.10
Pueblo, Colo.	.80	.60	...	1.20	...	1.15
San Diego, Calif.	...	.40@ .50	.80@1.00	.80@1.00	.65@ .80	.65@ .80
Seattle, Wash. (bunkers)	1.25	1.25	1.25	1.25	1.25	1.25

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Brookhaven, Miss.	...	...	...	...	...	.60
Burnside, Conn.	.75	...	...	...	...	...
Chicago district, Ill.	.35	...	...	...	...	...
Ferrysburg, Mich.	...	...	...	...	...	.65@1.00
East Hartford, Conn.	.75*	...	...	...	...	...
Gainesville, Texas	...	1.00	...	...	.55	...
Grand Rapids, Mich.	...	...	...	.50	...	...
Hamilton, Ohio	...	...	...	...	1.00	...
Hersey, Mich.	...	...	...	.50	...	...
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Lindsay, Texas	...	1.10	...	...	.55	...
Macon, Ga.	.35	...	...	...	...	...
Mankato, Minn.	.30	...	...	...	...	...
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Roseland, La.	...	...	...	...	.50	...
Somerset, Penn.	...	1.85@2.00	...	1.50@1.75	...	...
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00	...	...	...	...

*Cubic yd. ‡Delivered on job by truck. (a) ⅝-in. down. (b) River run. (c) 2½-in. and less. (d) Less 10c per ton if paid E.O.M. 10 days. (g) ¾-in. and less. ¶By truck only.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.25	2.00	2.25	1.50		3.75g	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	1.75	1.75		1.75	1.75@2.00		
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Columbus, Ohio	1.50@2.00	1.25@1.50	2.00	.30	1.75@2.00	2.75@4.50	
Dresden, Ohio	1.50@1.75	1.25@1.50	1.50@1.75	1.00@1.25			
Eau Claire & Chippewa Falls, Wis.						3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75		1.75			
Kasota, Minn.							1.00
Klondike, Mo.				2.00	2.00		2.00
Mapleton Depot, Pa.	2.00	2.00		2.00	2.00	2.00	
Massillon, Ohio	2.25	2.25		2.25	2.50		
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.				.30@ .35			
Millville, N. J.				1.75b		3.50	
Montoursville, Pa.				1.35@1.60	1.30		
New Lexington, O.	2.00	1.25					
Ohlton, Ohio	1.75b	1.75b		2.00b	1.75b	1.75b	
Ridgway, Penn.	1.50	1.50	1.75@2.00c				
Round Top, Md.				1.60		2.25	
San Francisco, Calif.[1]	3.50†	5.00†	3.50†	3.50@5.00†	3.50@5.00†	3.50@5.00†	
Silica, Va.	Potters' flint per ton, 9.00@10.00						
Thayers, Penn.	1.25	1.25		2.00			
Utica, Ill.	.55	.65		.75	.75		
Utica, Penn.	1.75	1.75		2.00			
Warwick, Ohio	1.50*@2.00	1.50*@2.00	1.50*@2.00	1.50*@2.00	1.50*@2.00		
Zanesville, Ohio	2.00	1.50	2.00	2.50	2.50		

*Green. †Fresh water washed, steam dried. [1]Core, washed and dried, 2.50. (b) Damp. (c) Shipped from Albany. (g) Dry.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium, Erie and Dubois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Penn.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	1.30*	1.80*	1.45*	1.45*	1.45*		
Jackson, Ohio	1.05*		1.30*	1.05*	1.30*	1.30*	
Toledo, Ohio	1.50	1.25	1.25	1.25	1.25	1.25	1.25
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.	1.45*		1.45*	1.45*	1.45*		
Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.								2.00[5]
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95[4]
Chazy, N. Y.		8.50	7.50	10.00		15.50[28]	8.50	14.00
Lime Ridge, Penn.							5.00[2]	
Pittsburgh, Penn.	12.50	8.50	8.50		9.00	11.00	8.00	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00[12]
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50	8.50	10.50	8.50	1.65[7]
CENTRAL:								
Afton, Mich.							8.40	1.39
Carey, Ohio	12.50	8.50	8.50		9.00		8.00	1.50
Cold Springs, Ohio		8.50	8.50				8.00	
Cold Springs and Gibsonburg, Ohio	12.50	8.50	8.50		9.00	11.00		
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio	12.50							
Milltown, Ind.		8.50@10.00		10.00[8]			8.50[22]	1.35[10]
Scioto & Marble Cliff, O.		8.50	8.50	9.50	8.25	.62½	7.50	1.50₃
Sheboygan, Wis.	11.50				9.50		9.50	
Wisconsin points[6]		11.50					9.50	
Woodville, Ohio	12.50	8.50	8.50	13.50	9.00	11.00	9.00	1.50₃
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Texas							7.00	1.50
Graystone & Landmark, Ala.		9.00	9.00	9.00			8.00	1.35
Keystone, Ala.		9.00		9.00	8.00	1.30	8.00	1.35
Knoxville, Tenn.	20.25	9.00	8.00	8.00	8.00	1.25	8.00	1.35
New Braunfels, Tex.	18.00	12.00	10.00	12.00	10.00		9.50	
Ocala, Fla.		11.00	10.00				11.00	1.40
Saginaw, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
WESTERN:								
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Los Angeles, Calif.	19.00	19.00	14.00		16.20		12.50	2.50
Dittlinger, Tex.		12.00@13.00					9.50[8]	1.50[23]
San Francisco, Calif.	20.00	20.00	13.50	21.00			14.50[30]	2.15
Tehachapi, Calif.					11.80			
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

[2] Net ton. [3] Wooden, steel 1.70. [4] Steel. [5] Per 180-lb. barrel. [6] Dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days. [7] 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65. [8] To 11.00. [10] To 1.50. [12] To 3.00. [22] To 9.00. [23] To 1.60. [28] Barrels. [29] F.o.b. Woodville. [30] To 16.50.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing Sand	Traction
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50
Mapleton Depot, Penn.	1.90	2.00
Massillon, Ohio		2.00
Michigan City, Ind.		.30
Mineral Ridge, Ohio	*1.75	*1.75
Montoursville, Penn.		1.10
Ohlton, Ohio	a1.75	a1.60
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50	3.50
Thayers, Penn.		2.25
Warwick, Ohio	2.00	2.00
Zanesville, Ohio		2.50

*Wet. †Fine; coarse dry, 3.00@3.50. (a) Green.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons	.08
Per gross	1.00@ 1.50
Chatsworth, Ga:	
Crude talc, grinding	5.00
Ground talc (150-200 mesh), bags	10.00
Pencils and steel worker's crayons, per gross	1.00@ 2.50
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	8.00@ 9.00
Including bags	9.00@10.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc (for grinding)	5.00
Ground talc (150-200 mesh), bags	12.00
Pencils and steel worker's crayons, per gross	1.00@ 2.50
Emeryville, N. Y.:	
(Double air floated) including bags; 325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bulk	8.50@13.00
Joliet, Ill.:	
Ground talc (200 mesh)	*20.00@30.00†
*Off color. †White.	
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (125-200 mesh), bags	10.00@15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Columbia, Tenn.—B.P.L. 65-70%	3.50@ 4.50
Gordonsburg, Tenn.—B.P.L. 65-72%	3.75@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 72%	5.50
Tennessee — F.o.b. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	8.00@ 9.00

Ground Rock

(2000 lb.)

Centerville, Tenn.—B.P.L. 65%	8.00
Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 65%	8.00@10.00
Twomey, Tenn.—B.P.L. 65%	8.00@ 9.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton)

Florida — F.o.b mines, gross ton, 68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H.—Per ton, Mine run	360.00
Clean shop scrap	25.00
Mine scrap	22.00
Roofing mica	30.00
Punch mica, per lb.	.12

Cut mica—50% from Standard List.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars	....	10.50
Brandon, Vt. — English pink, English cream and coral pink	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.— All colors and sizes	....	§5.00
Buckingham, Que.—Buff stucco dash	....	12.00@14.00
Chicago, Ill. — Stucco chips, in sacks, f.o.b. quarries	....	17.50
Crown Point, N. Y.— Mica spar	....	9.00@10.00
Dayton, Ohio	....	6.00@24.00
Easton, Penn.— Green stucco	....	12.00@18.00
Green granite	....	14.00@20.00
Haddam, Conn.—Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio—Concrete facings and stucco dash	....	6.00@24.00
Middlebrook, Mo.—Red	....	20.00@25.00
Middlebury, Vt.—Middlebury white	‡9.00	‡9.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags	....	5.50
Milwaukee, Wis.	....	14.00@34.00
Newark, N. J.—Roofing granules	....	7.50
New York, N. Y.—Red and yellow Verona	....	32.00
Red Granite, Wis.	....	˜.50
Stockton, Calif.—"Natrock" roofing grits	....	12.00@18.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	....
Wauwatosa, Wis.	....	20.00@32.00
Wellsville, Colo. — Colorado Travertine Stone	15.00	15.00

*Carloads, including bags; L.C.L. 14.50.
†C.L. L.C.L. 17.00.
‡Carloads, including bags; L.C.L. 10.00.
§Bulk, car lots, minimum 30 tons.

Potash Feldspar

Auburn and Topsham, Me. — Color white; 90% thru 140-mesh	19.00
Bristol, Tenn.—Color, white; analysis, K_2O, 6 to 10%; Na_2O, 2½ to 4%; SiO_2, 68 to 78%; Fe_2O_3, 12 to 20%; Al_2O_3, 16.5 to 18.5%; 99% thru 200 mesh; bulk, depending on grade	14.50@18.00
Brunswick, Me.—Color, white; 98% thru 140 mesh, bulk	19.00
Buckingham, Que.—Color, white, analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white, bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% thru 60 mesh, bags	16.00
96% thru 150 mesh, bags	28.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Glen Tay Station, Ont.—Color, red or pink; analysis, K_2O, 12.81%; crude (bulk)	7.00
Keystone, S. D.—Prime white; bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 12.16%; Na_2O, 1.53%; SiO_2, 65.60%; Fe_2O_3, .10%; Al_2O_3, 10.20%; crude	10.05
Pulverized, 95% thru 200 mesh; bags, 22.00; bulk	20.00
Murphysboro, Ill.—Color, prime white; analysis, K_2O, 12.60%; Na_2O, 2.35%; SiO_2, 63%; Fe_2O_3, .06%; Al_2O_3, 18.20%; 98% thru 200 mesh; bags, 21.00; bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 68% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00

Chicken Grits

Afton, Mich. (Limestone), per ton	1.75
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt.—Per ton	10.00
Cartersville, Ga.—(Limestone), per bag	2.00
Centerville, Iowa—(Gypsum), per ton	18.00
Chico, Texas — (Limestone), 100-lb. bags, per ton	8.00@ 9.00
Danbury, Conn.—(Limestone), bulk	6.00@ 7.00
Easton, Penn.—Per ton, bulk	3.00
Joliet, Ill.—(Limestone), bags, per ton	4.50
Knoxville, Tenn.—Per bag	1.25
Los Angeles, Calif.—(Feldspar), per ton	15.00
Gypsum, Ohio—(Gypsum), per ton	10.00
Limestone, Wash. — (Limestone), per ton	12.50
Marion, Va.—(Limestone), bulk, 5.00; bagged, 6.50; 100-lb. bag	.50
Rocky Point, Va.—(Limestone), 100-lb. bags, 50c; sacks, per ton, 6.00; bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	10.00
Warren, N. H.—(Mica), per ton	3.85@ 3.90
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone), bulk	‡7.50@*9.00
Wisconsin Points—(Limestone), per ton	9.00

*L.C.L. †Less than 5-ton lots. ‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	10.00@11.00
Anaheim, Calif.	10.50@11.00
Barton, Wis.	10.50@13.00b
Boston, Mass.	17.00*
Brighton, N. Y.	19.75*
Brownstone, Penn.	11.00
Dayton, Ohio	12.50@13.50
Detroit, Mich.	17.50*
Farmington, Conn.	13.00
Flint, Mich.	¶12.00@17.50*
Grand Rapids, Mich.	12.50
Hartford, Conn.	14.00
Jackson, Mich.	12.25
Lakeland, Fla.	10.00@11.00
Lake Helen, Fla.	9.00@12.00
Lancaster, N. Y.	12.25
Madison, Wis.	12.50
Michigan City, Ind.	11.00
Milwaukee, Wis.	13.00*
Minneapolis and St. Paul, Minn.	10.00
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	13.50@14.50
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	19.75*
Saginaw, Mich.	13.50
San Antonio, Texas	16.00
Sebewaing, Mich.	12.00
Sioux Falls, S. Dak.	13.00c
South River, N. J.	14.00
Syracuse, N. Y.	18.00@20.00*
Toronto, Canada	13.50@16.00*
Wilkinson, Fla.	12.00@16.00
Winnipeg, Canada	14.00

*Delivered on job. ¶Dealers' price. (b) Delivered to Milwaukee. (c) Delivered at yard.

Portland Cement

Prices per bag and per bbl., without bags, net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.86¾	3.47
Atlanta, Ga.	....	2.35
Baltimore, Md.	....	2.25
Birmingham, Ala.	....	2.30
Boston, Mass.	.52¾	2.13@2.23
Buffalo, N. Y.	.55	2.20@2.30
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa	....	2.24
Charleston, S. C.	....	2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio	.58	2.32
Cleveland, Ohio	....	2.24
Chicago, Ill.	.51¼	2.05
Columbus, Ohio	.57¼	2.29
Concrete, Wash.	....	2.35
Dallas, Texas	....	2.00
Davenport, Iowa	....	2.24
Dayton, Ohio	.58¼	2.33
Denver, Colo.	.66¼	2.65
Des Moines, Iowa	....	2.05
Detroit, Mich.	.48¾	1.95
Duluth, Minn.	....	2.04
Houston, Texas	....	2.00
Indianapolis, Ind.	.54¾	2.19
Jackson, Miss.	....	2.50
Jacksonville, Fla.	....	2.20
Jersey City, N. J.	....	2.13
Kansas City, Mo.	....	1.92
Los Angeles, Calif.	....	2.50
Louisville, Ky.	.55½	2.22
Memphis, Tenn.	....	2.50
Milwaukee, Wis.	....	2.20
Minneapolis, Minn.	....	2.12
Montreal, Que.	....	1.36
New Orleans, La.	....	2.20
New York, N. Y.	.48¼	1.93@2.03
Norfolk, Va.	....	2.07
Oklahoma City, Okla.	....	2.46
Omaha, Neb.	....	2.36
Peoria, Ill.	....	2.22
Philadelphia, Penn.	....	2.11@2.21
Phoenix, Ariz.	.81½	3.26
Pittsburgh, Penn.	....	2.04
Portland, Colo.	....	2.80
Portland, Ore.	....	2.60*
Reno, Nev.	....	2.91
Richmond, Va.	....	2.34
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.	....	2.21
Savannah, Ga.	....	2.50
St. Louis, Mo.	.51¼	2.05
St. Paul, Minn.	....	2.12
Seattle, Wash.	....	2.50*
Tampa, Fla.	....	2.25
Toledo, Ohio	....	2.20
Topeka, Kan.	....	2.41
Tulsa, Okla.	....	2.33
Wheeling, W. Va.	....	2.12
Winston-Salem, N. C.	....	2.62

NOTE—Add 40c per bbl. for bags.
*Less 10c discount.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Albany, N. Y.	....	2.15
Buffington, Ind.	....	1.80
Chattanooga, Tenn.	....	2.45*
Concrete, Wash.	....	2.50
Davenport, Calif.	....	2.45
Detroit, Mich.	....	2.15
Hannibal, Mo.	....	1.90
Hudson, N. Y.	....	1.65
Leeds, Ala.	....	1.85
Mildred, Kan.	....	2.35
Nazareth, Penn.	....	1.95
Northampton, Penn.	....	1.75
Richard City, Tenn.	....	2.05
Steelton, Minn.	....	1.85
Toledo, Ohio	....	2.20
Universal, Penn.	....	1.80

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	Plaster Board ¼x32x 36". Wt. 1500 lb. Per M Sq. Ft.	Plaster Board ⅜x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev., and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	....	....	....	....	11.70u	....	....	....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50			13.50			
Des Moines, Iowa	3.00	8.00	9.00	10.00	10.00	10.50	13.50	12.00	24.00	22.00	18.00	21.00	30.00
Detroit, Mich.	....	....	....	....	14.30o	12.30m	....	m9.00@11.00o	....	....	....	....	....
Delawanna, N. J.	....	....	....	....	....	8.00	....	9.00	....	....	.14½	.15½	30.00
Douglas, Ariz.	....	....	6.00	....	....	....	15.00	....	40.00	13.50	35.00	45.00	....
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50	....	24.55	20.00	....	....	....
Gypsum, Ohio	3.00	4.00	6.00	8.00	9.00	9.00	19.00	7.00	24.50	20.00	....	15.00	30.00
Los Angeles, Calif.	....	....	7.50@9.50	11.50y	....	....	....	....	....	....	....	....	....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	....	20.00	30.00
Portland, Colo.	....	....	....	10.00	....	....	....	....	....	....	....	....	....
San Francisco, Calif.	....	....	11.65m	13.40r	14.40r	....	15.40r	....	....	....	....	....	....
Seattle, Wash.	6.40	10.00	10.00	13.00	....	....	....	....	....	....	....	....	....
Sigurd, Utah	....	....	....	....	....	....	....	....	21.50	....	....	....	....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	....	....	....	....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (f) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board (t) to 16.50; (u) includes sacks; (v) F.O.B. N. Y. C. and dealer's yard in mill locality; (x) Hardwall plaster; (y) sacks 15c extra, rebated.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City or shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00		....
Cement City, Mich.		5x8x12—55.00¶	
Columbus, Ohio	18.00@20.00a	....	....
Detroit, Mich.	.16	....	.18
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	15.00@16.00a	....	....
Graettinger, Iowa	.18@ .20	....	....
Indianapolis, Ind.	.13@ .15†	....	....
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	16.00@18.00	....	....
Olivia and Mankato, Minn.	9.50b	....	....
Somerset, Penn.	.20@ .25	....	....
Tiskilwa, Ill.	.16@ .18†	....	....
Yakima, Wash.	20.00*	....	....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in. carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.		
Red		15.00
Green		18.00
Chicago, Ill.—Per sq.		20.00
Cicero, Ill.—Hawthorne roofing tile, per sq.	Chocolate, Red, Yellow, Gray, and Orange	Green, Blue
French and Spanish†	$11.50	$13.50
Ridges (each)	.25	.35
Hips	.25	.35
Hip starters	.50	.60
Hip terminals, 2-way	1.25	1.50
Hip terminals, 4-way	4.00	5.00
Mansard terminals	2.50	3.00
Gable finials	1.25	1.50
Gable starters	.25	.35
Gable finishers	.25	.35
*End bands	.25	.35
*Eave closers	.06	.08
*Ridge closers	.05	.06

*Used only with Spanish tile.
†Price per square.

Houston, Texas—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60
Longview, Wash.:	Per 1000
4x6x12	52.00
4x8x12	64.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 100
5x8x12	7.00
Houston, Texas:	
5x8x12 (Lightweight)	80.00
Pasadena, Calif. (Stone Tile):	Per 100
3½x4x12	3.00
3½x6x12	4.00
3½x8x12	5.50
Tiskilwa, Ill.:	Per 100
8x8	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile):	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis.:	
5x8x12	82.00
5x4x12	46.00
5x8x 6 (half-tile)	41.00
5x8x10 (fractional)	82.00
Yakima, Wash. (Building Tile):	
5x8x12	.10

Cement Building Tile

Cement City, Mich.:	Per 100
5x8x12	5.00
Grand Rapids, Mich.:	Per 100
5x8x12	8.00
5x4x12	4.50

Cement Drain Tile

Graettinger, Iowa—5 to 36 in., per ton	8.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile, per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	8.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00@40.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	....
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	25.00@75.00
Milwaukee, Wis.	14.00@15.00	20.00@40.00
Mt. Pleasant, N. Y.	....	14.00@23.00
Oak Park, Ill.	....	37.00@42.00
Omaha, Neb.	18.00	30.00@ 40.00
Pasadena, Calif.	10.00	....
Philadelphia, Penn.	14.75	20.00
Portland, Ore.	17.50	23.00@55.00
Mantel brick—100.00@150.00		
Prairie du Chien, Wis.	14.00	22.50@ 25.00
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Westmoreland Wharves, Penn.	14.75	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	....

†Gray. ‡Red. *Haydenite H. Brick.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.	15.00 per ton																
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	......	.40	.50	.60	.70	......	......	......	......	......	......	......
Gr'nd Rapids, Mich. (b)																	
Culvert pipe	......	......	......	.60	.72	1.00	1.28	1.60†	......	1.92	2.32	3.00	4.00	5.00	6.00	......	......
Sewer pipe (d)	......	......	......	......	......	.63	......	.60†	......	......	......	.58	......	......	......	......	......
Houston, Texas	......	.19	.28	.43	.55½	.90	1.30	......	1.70†	2.20	......	......	......	......	......	......	......
Indianapolis, Ind. (a)	......	......	......	.80	.90	1.10	1.30	......	......	1.70	......	2.70	......	......	......	......	......
Longview, Wash.	Sewer pipe 40% off list; culvert—list																
Mankato, Minn. (b)	......	......	......	......	......	......	......	......	......	1.50	1.75	2.50	3.25	4.25	......	......	......
Newark, N. J.	6 in. to 24 in., $18.00 per ton																
Norfolk, Neb. (b)	......	......	......	.90	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Olivia, Mankato, Minn.	12.00 per ton																
Paullina, Iowa‡	......	......	......	......	......	......	......	2.25	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Somerset, Penn.	......	......	......	......	1.08	1.25	1.65	......	......	2.50	......	3.65	4.85	7.50	8.50	......	......
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	......	......	......	......	......	......	......	......	......	......
Tiskilwa, Ill. (rein.) (a)	......	......	......	.65	.75	.85	1.10	1.60	......	1.90	......	2.25	3.40	......	5.50	......	......
Wahoo, Neb. (b)	......	......	......	......	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	4.62	6.14	6.96	7.78
Yakima, Wash.	$10.00 per ton																

30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced. (d) Eastern clay, list, 72% and 60% off.

21-in. diam. ‡Price per 2-ft. length. (d) 5-in. diam. [1]@1.08. [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00 [7]@7.50.

Recent Contract and Bid Prices

Bates County, Mo. Agstone at $1.40@1.60 per ton, c.i.f. county points, in carload lots of 40 tons minimum.

De Soto, Mo. Agstone at $1.50 per ton cars and $1.75 at bins.

South Bend, Wis. Municipal quarry quoting $2.25 per cu. yd. crushed rock, delivered in city limits.

Boston, Mass.—International Cement Corp., through its subsidiary, Knickerbocker Portland Cement Co., has made further reduction of 15c a bbl. in its product within the switching area of Greater Boston. President H. Struckmann said: "The principal reason for our action in reducing the price of our product in the Greater Boston area is a firm determination to preserve, against the encroachment of foreign cement, the market which our mill was constructed to serve."

Memphis, Mo. Agstone offered at $2.60 per ton on tracks.

Columbus, Ohio. Portland cement, delivered, is bringing $3.20 a bbl., according to quotations from leading building supply dealers in Columbus. This figure is about 35c under the 1926 scale. If taken at the yard, the same grade of cement sells for $3.10 a bbl.

Sands are practically the same. There has been a large demand for the Zanesville mason and Lake or Canadian sands this year, quoted at $3 and $3.50 a ton, respectively, dealers say.

Brandon, Vermont, to Have Art Stone Plant

THE Brandon Rock Products Co. is installing a plant for making art stone products, using marble chips from its quarry as aggregate. This company is a well-known producer of terrazzo chips and stucco and block facing aggregates. Its plant is at Brandon, Vt.

According to E. C. Rockwell, one of the vice-presidents of the firm, the company will make benches, bird baths, sun dials and decorative vases. These will be produced in various colors, the different shades of marble being used to achieve the effect.—*Brattleboro* (Vt.) *Reformer*.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Oldest Concrete Product Plant in Texas

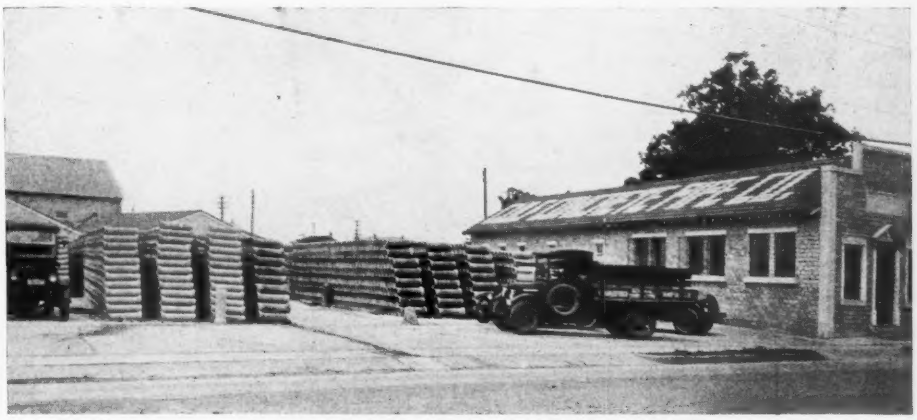
Gulf Concrete Pipe Co., of Houston, Now Makes a Variety of Products

THE Gulf Concrete Pipe Co. of Houston, Texas, is said to be the oldest concrete products manufacturing company in the state and the first company to make concrete pipe in the United States. It began with the manufacture of pipe and later enlarged its business to include concrete masonry units and roofing tile. It operates three plants in Houston, all of which are on Harrisburg boulevard, and admirably situated for making truck deliveries, and it is reported to be establishing a fourth plant in Brownsville, Texas.

The product of the plant enjoys a high reputation throughout a large area into which it is shipped. The pipe is made to meet A. S. T. M. specifications fully and to insure that these specifications are met a regular testing laboratory is maintained. Pipe are tested in this daily to withstand more than the pressure required by specifications and breaking tests are regularly made as a check on the strength.

In order that both impermeability and strength of product should result, the aggregates have to be carefully chosen and combined. Sand, fine gravel and crushed limestone from the quarries at New Braunfels, Texas, are the materials employed. They are combined to produce a given fineness modulus, but A. E. Johnson, the general superintendent of all the company's plants, says that the figure which expresses the fineness modulus is of little significance taken by itself. In other words, the concrete must have other qualities than the mere ability to resist compression, which is all that is required of ordinary mass concrete. To make concrete which has these qualities has required much study and experimenting with careful recording of results. Even now that the testing is wholly for assurance that the product is fully up to specification requirements, records of every test are kept on the same sheet as that on which the tests are recorded. From the data accumulated in this way very definite conclusions can be drawn. The regular testing of pipe enables the company to certify the quality of its product.

Pipe from 6-in. to 24-in. dia. are made. The McCracken pipe machine is employed for all sizes. Mechanical means are sub-



Yard and main office of Gulf Concrete Pipe Co.

The block and tile plant

Plant for making roofing tile

Cars are unloaded by portable conveyors

A light crane is used for stacking pipe

stituted for hand labor wherever possible. Aggregate is received in cars and transferred to bins beside the track by a portable elevator with swinging spout. Cement is received in sacks which are unloaded on to a portable inclined conveyor that lifts them to the upper floor of the main building for storage. In mixing, aggregates and water are carefully measured.

There are four curing rooms each 25 by 90 ft., each holding 1000 8-in. pipe or the equivalent in other sizes. In the curing rooms an inspector is placed and he goes over each pipe carefully as soon as the jacket has been taken off. In case any defects show the pipe is sent back at once to be made over. This is one more inspection than is given in most pipe factories, but it has been found to pay as defects are sometimes apparent in the green pipe which might not be so easy to discover later.

The McCracken machines are built at the plant under license from the owners of the patent. The trucks for handling green pipe are also built at the plant.

Branches and take-offs are made entirely by hand. In some plants the custom is to cut out an opening in the side of a green pipe, using a keyhole saw, and then to insert a branch made by hand to fit. But the Gulf company thinks a better and more uniform product is secured by making the entire piece, including spigot and bell, by hand.

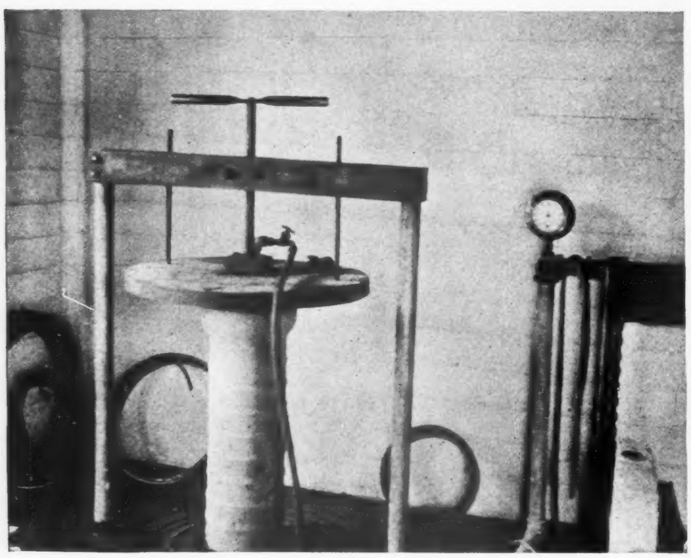
Half pipe for lining ditches

Curing is in an atmosphere of water vapor secured by fog nozzles. As soon as the pipe are sufficiently cured they are taken out of the rooms and stacked in the yard for further curing. A tractor, which has been converted into a crane by adding a boom and a drum for the wire rope, is used for this work. The use of this machine not only saves labor but it enables the pipe to be stacked much higher than would be possible by hand work.

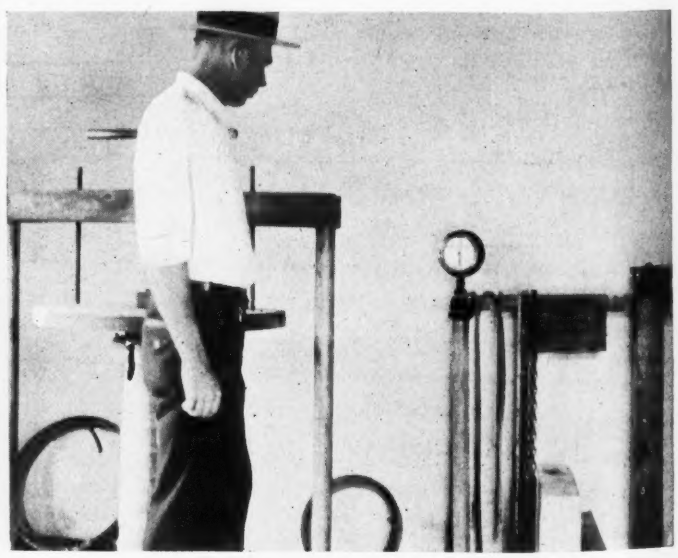
A special product of this plant is a half-pipe used as a lining for open ditches or flumes.

In the block department of this business which is some distance from the pipe plant, one "Universal" and two "Ideal" block and tile machines are in use. All of these are of the face-down pattern.

This company was a pioneer in the manufacture of lightweight tile and finds it to



Machine for testing by water pressure



Superintendent Johnson testing a pipe

be very popular with its customers.

As is usual in the parts of the United States where cold weather is not severe, a great deal of faced block is used in and around Houston. The Gulf company makes this in plain and rock cut face, using a number of special aggregates for facing. Some especially handsome combinations have been worked out with aggregates obtainable locally. The body of all block and tile is made of sand and crushed limestone, however. L. P. Smith is in charge of this plant.

The tile plant a short distance from the block plant makes a roofing tile marketed under the name "Waterseal."

N. A. Epps is president and general manager of all three plants.

New Concrete Products Association

THE Concrete Products Association of Alabama has been organized with the following officers, Geo. A. Toulmin, Toulmin Tile Co., Mobile, president; W. L. Sibley, Economy Duntile Co., Birmingham, vice president; Tom. W. Newton, Portland Cement association, secretary.

The association is open to every concrete products manufacturer in the state of Alabama providing the quality of the product is kept up to the standard set by this organization.

A committee consisting of C. A. Baronowski, of the Birmingham Slag Co., F. G. Smithson, Concrete Products Co., E. L. Carter, LaMore Concrete Tile Co., all of Birmingham, has been appointed to perfect the details of the association.

Northwest Products Men to Meet in Frisco

PLANS are being laid by prominent men in the concrete products industries in the Pacific Northwest to take a large delegation of Northwest manufacturers to San Francisco, July 15 and 16, to attend there the annual convention of the California Associated Concrete Pipe Manufacturers and the meeting of the Irrigation Appliances Association.

To this end a meeting between William H. Sharp of Longview, president of the Northwest Concrete Products Association; J. J. Collins of Portland, secretary-treasurer, and William MacKenzie of Portland, publicity chairman, was held recently and as a result Mr. MacKenzie left Portland for San Francisco to meet with Fred Holthouse, president, and H. W. Cutter, secretary of the southern association, to lay plans for the northwest delegation.

The plan is for most of the members of the Northwest association to take part in the California meeting and return to Oregon in time for the semi-annual meeting of the Northwest association at Astoria on July 29 and 30.—*Seattle* (Wash.) *Journal of Commerce.*

Stone Tile Company of Spartanburg (S. C.) to Begin Operating

THE Stone-Tile Manufacturing Co., located on West Henry Street, Spartanburg, S. C., will soon begin the manufacture of building tiles at their plant.

With the recent completion of the organization, preparations were made for the installation of machinery and equipment at the plant location. The plant will have a capacity output of between 3000 and 5000 stone tiles daily, for the present. The company is the licensee of the National Stone-Tile Co. and has rights for the sale of the product in six counties of South Carolina. Stone and sand to be used in the manufacturing will be furnished by Spartanburg county, while cement and other ingredients will be shipped in.

The firm is capitalized at $10,000. D. C. Todd is president and treasurer, and A. S. Ancrum is vice-president and secretary.

Los Angeles Art Stone Makers Organize

ORGANIZATION of eight leading Los Angeles, Calif., art stone manufacturers for the purpose of standardizing the quality of their product was announced recently by Frank M. Brooks, head of the Brooks Art Stone Corp., who has been elected president of the association. The organization will be known as the Association of Art Stone Manufacturers and the products of its members as certified art stone.

A rigid set of specifications has been adopted to govern manufacturing processes and the quality of materials to be used. Arrangements have been made with the Raymond G. Osborne Laboratory for regular inspections of the plants of the members and architects incorporating the specifications in building plans will receive a report on the product of the member to whom the contract for the stone is let.

Brooks, in discussing the formation of the association, said that steps to protect the quality of art stone were decided upon because of the fact that the product of a few establishments has been manufactured in too great a hurry and, in some instances, the best materials have not been used.

Firms which hold membership in the association include: Kendall and Delaney, Henry Decorative Stone Co., Brooks Art Stone Corp., California Staff and Stone Co., MacGruer and Co., Mission Staff and Stone Co. and Watkins Co., Inc.

Serving as officers with President Brooks are John H. Delaney vice-president; W. Watkins, treasurer, and A. C. Horner of the Portland Cement Co., secretary.—*Los Angeles Express.*

Fire Damages Concrete Block Plant

THE Hundhausen Concrete Block Mfg. Co.'s plant at Peoria, Ill., was recently damaged by a fire of undetermined origin, entailing a reported loss of $15,000, which, however, was covered by insurance, states the *Peoria* (Ill.) *Journal.*

The fire was discovered by residents in the neighborhood of the plant, who turned in the alarm. By the time several companies of fire fighters arrived the place was a mass of flames and little could be done except to prevent the fire from spreading. The firemen on investigation reported that the fire had started in the plant engine room. According to William Hundhausen, owner of the plant, the greatest loss sustained was the machinery, which was damaged beyond repair.

Superior Sewer Pipe Co. Now in Operation

THE new concrete pipe plant of the Superior Sewer Pipe Co., Columbia, S. C., is reported to be in operation. The company is manufacturing three types of pipe, culvert, sanitary sewer and storm drain, using the McCracken process, machinery for which was furnished by the McCracken Machinery Co., Sioux City, Iowa. All materials used, except the cement are bought from local concerns. The sand is from the Southern Silica Mining and Manufacturing Co. and the stone is from the Weston and Brooker quarry at Cayce, S. C.

The plant is located on a spur track of the Southern and Atlantic Coast Line railroads just beyond the state fair grounds. Ample storage facilities are provided as well as ample track space for the loading and unloading of cars.

The company is reported to have the contract for all culvert pipe to be used by the South Carolina highway department for a period of six months. It is believed by Mr. Legare that much of the pipe for the highways of the Capital district will be manufactured at the Columbia plant as work on those roads is to start at once.

T. Keith Legare of Columbia is vice-president of the company and is manager of the Columbia plant. C. R. Johnson is president of the organization, which has another pipe plant at Camp Sevier near Greenville. J. R. Nichols is plant superintendent.—*Columbia* (S. C.) *Star.*

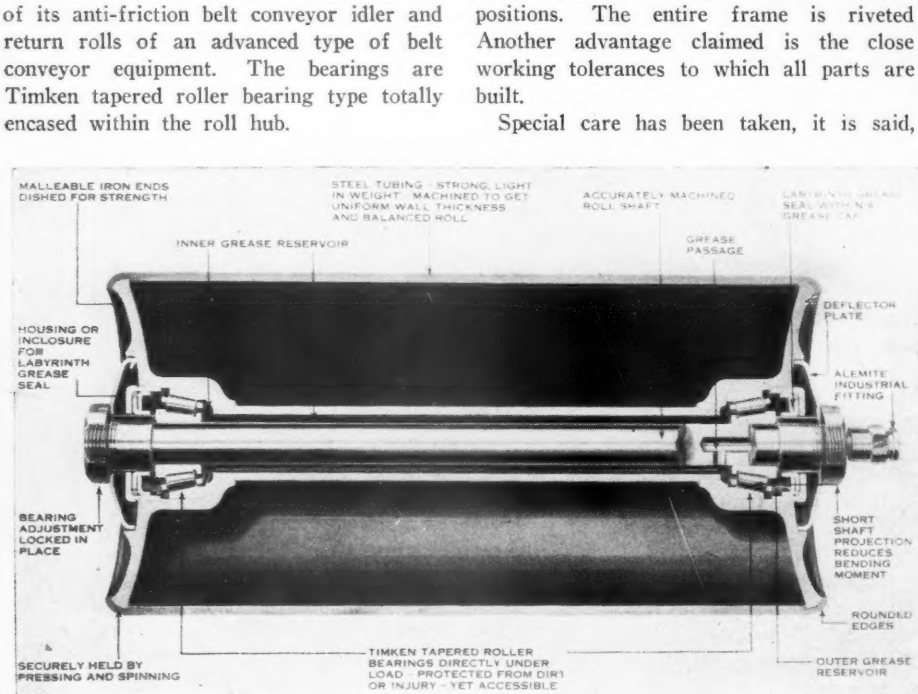
Florida Block Company Builds New Warehouse

THE Maul Ojus Rock Products Co. of West Palm Beach, Fla., has built a new warehouse to supply what is known as the Flamingo district with building block. The company is one of the large producers of crushed stone and concrete building units of Florida.

New Machinery and Equipment

New Anti-Friction Belt Conveyor Idler

ANNOUNCEMENT is made by Link-Belt Co., Chicago, of the introduction of its anti-friction belt conveyor idler and return rolls of an advanced type of belt conveyor equipment. The bearings are Timken tapered roller bearing type totally encased within the roll hub.



General construction details of new anti-friction idler roll

The outstanding features claimed for the idler is the protection afforded by a labyrinth grease seal, mounted in a grease cap which also serves as an outboard reservoir and lubricates the bearing on the outside as well as on the inside, especially when the roll is on an incline. This, in turn, is protected by a deflector plate to deflect dirt, dust, grit or any foreign material away from the bearings and grease seal, and stop the washing of the grease away from the labyrinth.

The rolls are monuted on a self-cleaning "T" base. All rolls are interchangeable, being capable of serving in any of the three positions. The entire frame is riveted Another advantage claimed is the close working tolerances to which all parts are built.

Special care has been taken, it is said, to assure alignment of bearings and a well-balanced concentrically running roll. The machined heads are pressed and held in place by spinning and are dished for rigidity and strength.

The idler rolls are supported in malleable iron brackets having a large bearing surface for supporting them. The brackets are so constructed as to support the ends of two adjacent rolls, and secure alignment of rolls.

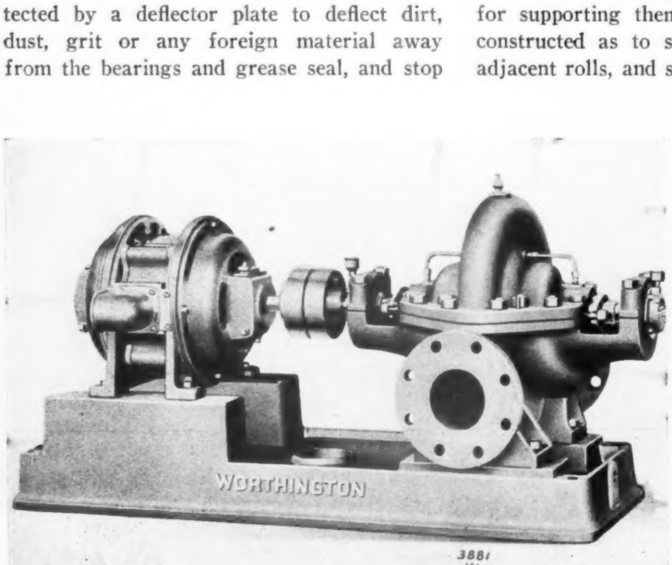
Troughing idler and return idler—cut away to show roll construction

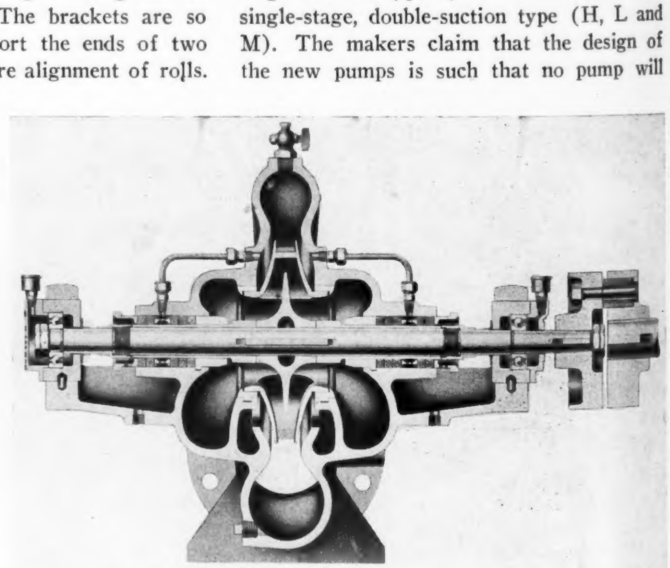
Roll shafts are supported at both ends close to the rolls, without overhang, to minimize the bending moment. Rolls are spaced far enough apart to permit convenient removal from the frame by simply lifting them out without the use of any tools.

Idler rolls are made in various standard lengths, and they are furnished in combinations to suit standard belt widths. The end stands are riveted to the "T" iron base, and are spread at the foot to present a rigid support for the idler.

New Centrifugal Pumps

THE Worthington Pump and Machinery Corp., New York, N. Y., has recently developed several new lines of general service pumps, the outstanding feature of which is said to be their high efficiencies. These new pumps are now being carried in stock for standard motor speeds up to 3600 r.p.m. The new lines available embrace three types as follows: a single-stage, single-suction type (known as R and S); a two-stage, single-suction type (known as U), and a single-stage, double-suction type (H, L and M). The makers claim that the design of the new pumps is such that no pump will





New centrifugal pump of the double-suction type—a typical section is shown at the right

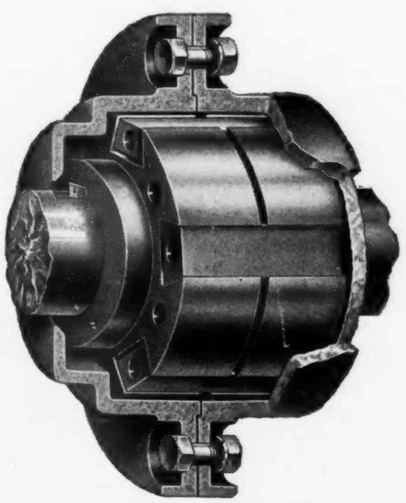
overload a standard motor of the horsepower and speed specified under any operating conditions to which the pump may be subjected in service.

The pump casing is horizontally split, a feature of design, the manufacturers say, to produce a smooth flow with no abrupt changes in velocity from the suction inlet to the discharge outlet, thus effecting a higher hydraulic efficiency. The suction passage is of volute form, which results in stream-line flow to the entrance of the impeller. In the single-suction pumps the back of the impeller acts as a hydraulic balance. Double-suction types are inherently hydraulically balanced.

All the new pumps are equipped with deep-groove ball bearings, the outboard bearing being so mounted as to take unbalanced thrust in either direction. Each bearing operates in a one-piece hardened steel housing held in place by a yoke. By removing the housing yokes, the shaft complete with bearings and bearing housings can be removed from the pump as a unit and replaced without disturbing the alignment. The bedplate is designed to take standard makes of motors. It is provided with a raised lip, sloping top and drain.

Improved Flexible Coupling

IMPROVED lubrication features are claimed for the Nicholson flexible coupling manufactured by W. H. Nicholson & Co., Wilkes-Barre, Penn. The illustration shows the longitudinally drilled holes through the floating keys and the hubs which act as reservoirs for oil. A lip is extended



Improved flexible coupling

from this casing over the left hub of the coupling, and into which oil can be squirted with an oil can, either when standing or in motion. With this added space and that created by the holes, the coupling is said to carry approximately 150% more oil than the old type. This oil lip type will be known as Style "A" and the old type without the oil lip the Style "B." With the added oil carrying capacity the working parts are said to be flooded at all times and a perfect oil film maintained between the moving surfaces, thereby, it is claimed, decreasing wear to a minimum and affording an oil cushioning effect between the driving parts.

New Crawler Dump Wagon

THE Western Wheeled Scraper Co., Aurora, Ill., has developed a crawler dump wagon of 7 cu. yd. capacity, that is claimed to allow the full power of a high-powered tractor to be utilized to advantage in the hauling of dirt or stone. While designed primarily to give grading contractors a dump wagon of great size that will follow wherever a caterpillar tractor can lead, it is adaptable to the handling of stone and gravel from pit to crusher.

New crawler dump wagon for hauling gravel or stone to and from crusher

The 7-yd. wagon is equipped with Athey truss wheels, offering, it is said, a minimum of ground resistance with ability to carry about 90% of the load. Under normal haulage conditions, a single Caterpillar "60," it is claimed, has handled with ease a train of two Western 7-yd. crawler dump wagons loaded to capacity.

The new machine is an all-steel wagon. The side sheets are of steel, are 3/16 in. thick, reinforced on the edges against the shocks from power shovel loading, and is hot riveted as far as is practicable. There are two sets of bottom dump doors, one in front and one in back of the axle. These are wound up by the operator by means of a ratchet adjustment at the front, much as on a standard Western dump wagon. Two sets of doors drop either simultaneously, or the back doors can be dropped and raised independent of the front doors. The mechanism controlling the doors is all on the outside, leaving no chain, cable, or other obstacles to prevent free discharge.

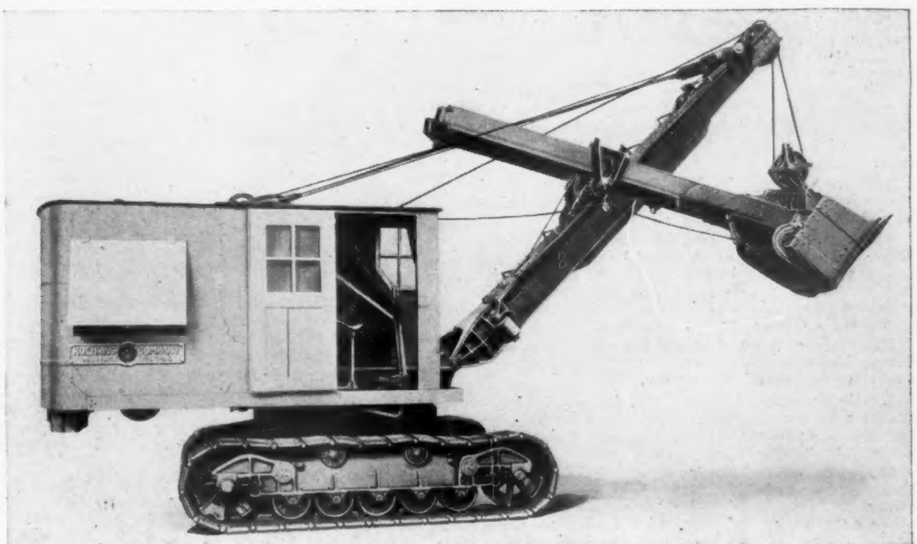
The crawler dump wagon can be turned in any cut where a power shovel can revolve and can move in safety over any dump where a tractor can move, the manufacturers say.

New Shovel-Crane-Dragline

THE Koehring Co., Milwaukee, Wis., has just brought out a new machine, the 501, which is either a shovel, crane, or dragline, as specified, with capacities ranging from 1½ to 1 cu. yd. of material.

An innovation in this machine is the method of rating the shovel. The choice of three sizes of dippers may be had, depending upon the length of the dipper sticks and the kind of work for which the machine is to be used. With 13-ft. sticks a 1½-cu. yd. dipper is furnished; with 16-ft. sticks, 1¼ and with 19-ft. sticks, 1-cu. yd. dipper. The boom length is 24 ft. in each case.

Other claimed features are the shovel power dipper trip, the special swiveling boom point fairlead for the dragline, cast steel car body, multiplane girders and side frames, ball-bearing-mounted high speed shafts and roller bearing-mounted vertical traction and swing shafts. A Koehring-Wisconsin four-cylinder 6 x 7 gasoline engine, running at 925 r.p.m., furnishes the power, with an optional choice of electric motor.



New shovel-crane-dragline

News of All the Industry

Incorporations

Lynnmour Sand and Gravel Co., Ltd., 402 Northwest Bldg., Vancouver, B. C., $10,000.

Waterseal Concrete Shingle Co., Cumberland, Md., $25,000. John A. Anderson, Frank A. Stein and Bernard F. Farrell.

American Asphalt Co. of Kansas and Missouri, Wilmington, Del., $100,000. Deal in cement, asphalt, etc.

Belfield Concrete Products Co., Inc., Wilmington, Del., $200,000. Deal in concrete products, lime, etc.

Mid-Island Sand and Gravel Corp., Long Beach, N. J., 5000 shares. (Shaw & Knob, Long Beach, attorneys.)

Clearwater Sand and Shell Co., Inc., Clearwater, Fla., $25,000. A. H. Zimmerman and Ed N. Eaton.

Capital City Sand and Gravel Co., Tallahassee, Fla., $200,000; 2000 shares, with par value of $100 each. H. D. Trawick, C. A. Goldsmith and C. L. Waller.

Massachusetts Sand and Gravel Assn., Inc., Boston, Mass., 100 shares, no par value. Michael Tobin, Joseph G. Bryer, 46 Warwick Road, Melrose Highlands, Mass., and Avis M. Callahan.

Oregon White Lime Co., Oregon City, Ore., $50,000. To engage in mining business. Richard Turpin, J. Frank Turpin and Lulu M. Turpin. (B. F. Lindas, 10 Hogg Bldg., Oregon City, Ore., attorney.)

Pennsylvania Glass Sand Corp., West Virginia, organized under laws of Pennsylvania, $15,000,000. To produce silica sand. A. J. Fink and Addison E. Mullikin, Citizens National Bank Bldg., and Henry P. Bridges, all of Baltimore, Md.

Sil-A-Site Corp., Atlanta, Ga., $100,000. To manufacture a new type of building material. A. R. Reynolds, formerly of Los Angeles; A. D. Walters, formerly of Minneapolis, and C. B. Gallagher, formerly of New York.

Crystal Gray Crushed Marble Lime Co., Knoxville, Tenn., $10,000. To deal in crushed marble, limestone and marble and limestone products. J. H. Boyd, A. C. Coleman, J. M. Lek, Shirley Lee Chambers and James E. Moore.

Diamond Gravel and Lumber Co., Murfreesboro, Ark., $50,000. To own, lease and operate gravel pits, mineral deposits, saw and planing mills. John A. Davis, Hartwell Greeson, Frank Stroupe, W. G. Stainton, Z. A. Copeland, W. W. Womack and H. A. Loomis.

Quarries

Oregon Lime Products Co., Portland, Ore., has purchased limestone deposits near Falls City from A. A. Muck, amounting to 186 acres. The company plans to develop the deposits for commercial fertilizer.

J. E. Osborn & Son, Belle Center, Ohio, has installed a new auxiliary crusher, screening equipment, and has erected larger bins at their quarry here.

Western Quarry, Tenino, Wash., has received the order for stone to be used on the new buildings being erected at Camp Lewis.

San Jacinto Rock Products Co., San Jacinto, Calif., recently shipped their first carload of limestone, the company having previously confined itself to shipping silica and crushed rock. It is expected that this will be the beginning of an important industry for the company.

New Haven Road Construction Co., Lannsville, Mass., has moved its portable type rock crushing outfit to the Fitzgibbon quarry.

Brodie Quarries, Lyons, Colo., has received the contract to supply the crushed stone to be used on the Longmont-Lafayette road, which will amount to about 16,000 tons.

Shakopee, Minn. Business men from St. Paul and Minneapolis, Minn., the twin cities, are reported to be negotiating for the purchase of limestone quarries located here, with a view to establishing a crushed and building stone business.

L. N. and P. Lime Rock Co., Williston, Fla., is reported to have been sold to L. E. Leslie.

Eugene, Ore. Edward C. Finnell has received the contract for crushed stone to be used for highway work from the Lane county court. The rock will be taken from the quarry at Eugene.

Sand and Gravel

Warren Silesia Sand Co., Warren, Penn., was recently sold to H. Rothchilds of Warren.

West Liberty, Ohio. The Logan county commissioners have purchased a new Haiss gravel loading machine costing $3,000, equipped with caterpillar treads and powered by a gasoline engine.

Oregon, Ill. The Cox & Warner Co.'s rock crusher has been installed in the Cullinan gravel pit, preparatory to starting work on Lafayette road.

Adrian, Mich. The rock crusher purchased by this city about two years ago, but never assembled, has been put up and is now in operation at the gravel pit on Bent Oak Avenue.

Salem Sand and Gravel Co., Salem, Ore., is building a new sand and gravel dredge in which one of the steam-winch boilers from the now dismantled battleship Oregon has been installed.

Arkansas Sand and Gravel Co., Van Buren, Ark. A half interest in this company was recently purchased by R. C. Bollinger of Fort Smith, Ark., for $6,000 from Frank R. Euper.

Pioneer Sand and Gravel Co., Seattle, Wash., recently donated $100 to the $25,000 fund being raised for a prize purse to be awarded to the winner of the proposed Seattle to Tokyo nonstop air flight.

Knoxville Sand and Lime Co., Knoxville, Tenn., recently purchased a warehouse and office building formerly belonging to the Davis-Porter Co.

Missouri Sand and Gravel Co., Louisiana, Mo., reports that its plant on the river front here has been put into operation after being idle since last fall.

Spalding Lumber Co., Visalia, Calif., reports the completion of its new sand and gravel storage bunkers. The bunkers were designed by A. D. Hadley, engineer for the Coast Rock and Gravel Co. of San Francisco, and have a storage capacity of 750 tons.

Crystal Sand Co., Mission, Texas. The new company recently organized (Rock Products, May 14) is making arrangements for marketing its product.

Bronte, Texas. The Humlong ranch near here reports that the demand for sand and gravel in this district is heavy. An average of 100 cars per month have been sold this year, and up to June 11, 61 cars had been loaded out from this ranch since the first of the month.

Wolf Creek Sand and Gravel Co., Inc., St. Louis, Mo., according to J. E. Swartz, secretary, plans to increase its capacity and put in additional equipment.

Bellingham, Wash. R. C. Sisson, a local contractor, is said to be planning the erection of a gravel washing plant and storage bunkers on Baker creek, at an estimated cost of $2,500.

Western Indiana Gravel Co., West Lafayette, Ind., has received the contracts to supply the gravel to be used on state roads 41 and 52, amounting to about 2200 cars in all.

Fond du Lac, Wis. The county rock crushing outfit with Jay Dyer in charge has been moved from Alto to Fairwater and will be used for resurfacing highway E between Fairwater and Ripon.

Bad Axe, Mich. John J. Campbell, chairman of the county road commission, announced the purchase of a 40-acre gravel pit by the county near Verona, at a reported sum of $5,000.

Diamond Gravel and Lumber Co., Murfreesboro, Ark., reports that its new gravel plant on Prairie creek has been started. The new plant is run by steam power, although everything is ready except putting in motors to change it to electrical operation.

Ohio River Sand and Gravel Co., Wheeling, W. Va., is contemplating the purchase of new floating and shore equipment for use at its several plants. The company also expects to buy additional property near Parkersburg, Wheeling, Neal's Island, New Martinsville and Williamstown, W.Va., where its plants are located.

Consumers Rock and Gravel Co., Los Angeles, Calif. This company has just issued an attractive three-color (black, green and yellow) direct-by-mail circular which tells the story of the company's progress and contains pictures of the various branches, bunkers, pits, batching bins and some of the motor trucks comprising the delivery service.

Cement

Beaver Portland Cement Co. has closed its Gold Hill, Ore., cement plant for the usual annual repair and overhauling period of about 30 days. The report states that the storage bunkers are adequately filled to take care of all orders.

Trinity Portland Cement Co., Dallas, Texas, is rushing work on its new $3,000,000 cement plant at Houston so that production may start by September 1 of this year.

Keystone Portland Cement Co., Allentown, Penn., has let the general contract for its cement plant at Bath, Penn., to the M. A. Long Co. of 10 W. Chase St., Baltimore, Md. The new plant will cost approximately $1,000,000 with machinery. John Buckland is president of the company.

Superior Portland Cement Co., Seattle, Wash. The employes of this company with the assistance of some of the officials have started a monthly paper dealing with safety matters, news notes about the plant and special articles.

Cement Products

Hawthorne Roofing Tile Co. has moved its general offices from Cicero, Ill., to suite 1446-48 Builders' Bldg., Chicago, Ill.

W. D. Haden, Houston, Texas. Sid Clark, representative of the company, reports heavy and increasing demand for "Stone-Tile" building units in this district and looks for the possibility of expanding the size and capacity of the plant, which now turns out about 22,500 units per day.

Eastwood Sand and Gravel Co., Grayville, Ill., is reported to have started a plant to manufacture concrete blocks, tile, brick and decorative pieces.

California Stone-Tile Co., Van Nuys, Calif., has completed its new San Fernando valley plant and through Robert E. Johnstone, president, announces the appointment of C. S. Warner as sales representative for the Van Nuys district.

Gypsum

National Gypsum Co., Buffalo, N. Y., is reported to be negotiating with parties controlling some of the gypsum deposits at Deep Brook, Canada, with a view to developing trade in gypsum rock.

United States Gypsum Co., Chicago, Ill., is preparing plans for alterations to its Philadelphia, Penn., warehouse to cost approximately $35,000.

Albert County, N. B. The British Empire Mining and Metallurgical Congress will visit the maritime provinces in September, making Moncton, N. B., their headquarters for an investigation of the gypsum and other deposits of Albert county.

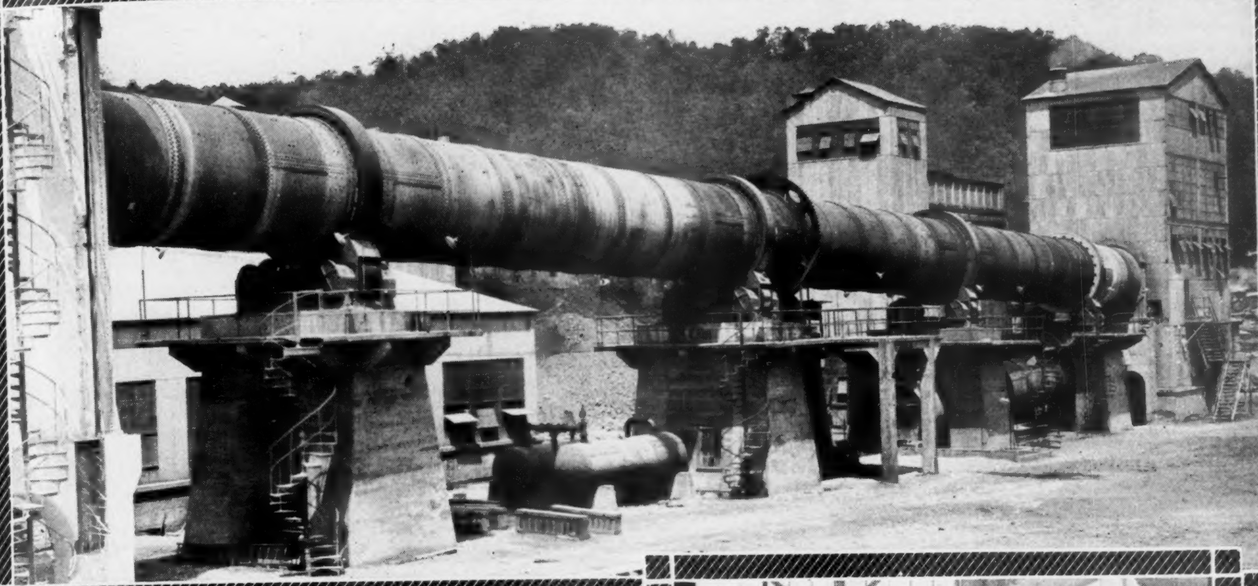
Beaver Products Co., Inc., Buffalo, N. Y., has secured the patent rights in the United States to manufacture "Elo" panels, an English wallboard, made of cement and other products. The plant is to be enlarged and additional equipment installed, to begin manufacturing in about six months.

Miscellaneous Rock Products

Southwestern Consolidated Graphite Mines, Burnet, Texas, has started work preparatory to building a new, modern plant to replace the one which was burned.

Texas Gulf Sulphur Co., Gulf, Texas, is planning to prospect new sulphur deposits which may lead to the construction of new plants.

Hayes Brothers, Camilla, Ga., are reported to have an extensive tract of silica sand deposit land which they are planning to develop.



Another Modern Plant
Equipped With
Allis-Chalmers
Cement Mill Machinery

Here is another new installation using Allis-Chalmers machinery. This modern plant of the West Penn Cement Company at West Winfield, Pa., has as its major equipment—

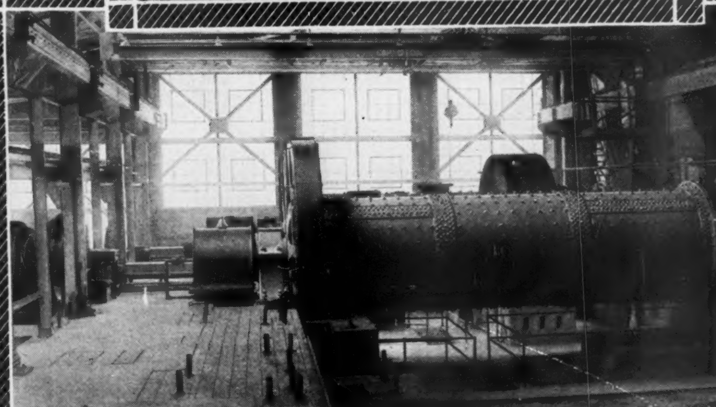
One 11′ 6″ x 250′ four support kiln with two roller carrying mechanism of self lubricating type provided for water cooling and direct connected gear drive train with cut steel gears.

One 9′ x 90′ cooler.

Two 8′ x 30′ Raw Grinding Compeb Mills.

One 8′ x 30′ finish grinding compeb mill.

Three 800 H.P. Synchronous Motors, as well as the other motors in the plant are of Allis-Chalmers make.



Allis-Chalmers equipment is used in most modern mills. Allis-Chalmers manufacturing facilities and engineering service are known and appreciated by these plants.

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

Blue Diamond Co., Inc., of Birmingham, Ala., announces the opening of their new and modern plant producing "Blue Diamond" cement, lime, sand and machine mixed, ready to use brick mortar. This company delivers the mortar at the job, in special trucks, in any desired quantity.

Everett-Saxton Co., Everett, Penn., has awarded the contract for its new lime and hydrate plant to the McGann Manufacturing Co., York, Penn. The lime plant will contain three York coal-fired kilns and the hydrate plant will be a complete Schulthess hydrate plant with a capacity of 75 tons a day. Work on this plant will begin July 11.

Personals

J. V. N. Dorr, president of the Dorr Co. of New York, was honored recently by having the degree of Doctor of Science conferred upon him by Rutgers University in consideration of the important contributions to the metallurgical and chemical industries made by him.

Dr. Dorr, after early association with Thomas A. Edison, gained experience as a metallurgical chemist in the mining regions in the Black Hills of South Dakota. He later entered into a partnership and personally undertook the reconstruction of a previously unprofitable gold milling operation which became widely known because of a new method of classification which he originated.

Dr. Dorr introduced the apparatus by which the process of settling is made continuous. As an outcome, counter current washing was made continuous and has been adopted in the metallurgical industry for the recovery of solutions of gold, silver, copper, zinc, etc., from the treatment of their ores and in many chemical industries where solids are washed free from solutions. These principles of operation are now standard practice in metallurgical, chemical and many manufacturing industries not only in this country but throughout the world.

Like all leaders, Dr. Dorr gives credit for much of his success to the efforts of his associates both in this country and abroad, many of whom have worked with him since his South Dakota days. To collaborate with his associates abroad, Dr. Dorr is now in Europe.

Charles Hull Ewing, former secretary and treasurer of the Southern Gypsum Co., is one of the founders of a new riding and golf club at Lake Forest, Ill., to be known as the Lake Forest Saddle and Golf Club. The property consists of 570 acres, near the famous Melody farm of J. Ogden Armour.

A. D. Kingsley, New York, president of the Pacific Lime Co. and its affiliated organization, the Kingsley Navigation Co., recently visited Vancouver, B. C., to inspect the company's property located there.

W. H. Klein, general superintendent of the Penn-Dixie Cement Co. at Richard City, Tenn., has been elected to the executive committee of the American Society for Testing Materials.

Leo W. McNerney, Carthage, Mo., for the past few years manager of the Lantz-Missouri Marble Co. of Carthage, has been appointed general manager for the Joplin Marble Quarries Co. of Joplin, Mo. Mr. McNerney will take over his new duties on July 15. The stone work on the Missouri state capitol, the Elks memorial and the Stevens hotel in Chicago, and the Canal National Bank in New Orleans, was supervised by Mr. McNerney. He will move to Joplin as soon as his affairs and interests in Carthage have been arranged.

Duff A. Abrams, director of research for the International Cement Corp. of New York, has been invited to address the meeting of civil engineers, contractors and cement men being arranged by the Portland Cement Association, to be held in St. Joseph, Mo., soon.

J. T. Lintner, Port Clinton, Ohio, superintendent of mines for the United States Gypsum Co. at the Gypsum, Ohio, plant for the past four years, has been transferred to the Bakerfield, N. Y. plant, where he will have charge of the mining operations.

Frank P. Jones, president of the Canada Cement Co., recently made an inspection tour of the company's gypsum products plant at Chester, Penn.

Obituaries

Guy Eastman Tripp, New York City, N. Y., chairman of the board of directors of the Westinghouse Electric and Manufacturing Co., died June 14 from complications following an operation.

Brigadier General Guy E. Tripp was born in Wells, Maine, April 22, 1865. He was educated at South Berwick (Maine) Academy and at the age of 18 entered the employ of the Eastern Railway Co. In 1890 he became storekeeper for the Thompson-Houston Electric Co. Shortly afterwards he was made traveling auditor for this company. He became associated with Stone and Webster in 1897. It was while with this company that he was appointed their special representative in managing their reorganization of the Metropolitan Street Railway Co. of New York, then in the hands of receivers, and he accomplished the task in such a satisfactory manner that in 1912 he was appointed chairman of the board of directors of the Westinghouse Electric and Manufacturing Co., in which capacity he continued until his death.

The rating of brigadier general was bestowed upon him by the government for his work during the war in the ordnance department.

Carlos P. Watkins, field engineer for the Portland Cement Association, died June 30 at Columbia Hospital, Seattle, Wash.

Manufacturers

General Electric Co., Schenectady, N. Y., announces the appointment of E. M. Hewlett as consulting engineer, switchboard department of the company. The appointment is effective as of June 1, 1927.

Mr. Hewlett has been engineer of the switchboard department since its formation, and will be succeeded in that capacity by E. B. Merriam. The number of assistant engineers has been increased to three by the appointment of Chester Lichtenberg, with headquarters at Philadelphia. Other changes in the switchboard engineering organization include the appointments of W. K. Rankin as assistant designing engineer with headquarters at Schenectady, and G. E. Stewart with the same title but making his headquarters at West Philadelphia.

Foos Gas Engine Co., Springfield, Ohio, announces the change of its corporate name to Foos Engine Co. At the meeting of the board of directors, J. F. Baker was elected president and M. E. Baker, secretary-treasurer of the company. Several new department assignments have been made, among them being R. C. Burrus to the position of sales manager; W. W. Schettler, chief engineer, and G. F. Noltein, mechanical engineer. The new program of the company includes the establishment of a branch factory at Tulsa, Okla.

William Ganschow Co. announce the appointment of Schroer Bros., 2303-2305 Holmes street, Kansas City, Mo., as exclusive representatives in the states of Kansas and Oklahoma.

Hyman-Michaels Co., Chicago, Ill., have appointed the Hofius Steel and Equipment Co., Seattle, Wash., representatives in Washington and the northwestern territory.

Lincoln Electric Co. announce the following changes and additions to their sales and service department: L. P. Henderson, formerly connected with the Detroit office, has been transferred to Chicago in charge of welder service; J. E. Durstine has been transferred from the experimental engineering department to welder service department at Cleveland; J. W. Shugars of the time study department at Cleveland, and R. D. Layman, also of Cleveland, have been moved to Detroit under the direction of J. M. Robinson; D. H. Carver has been transferred from the machine shop division at Cleveland to the Ohio service division with headquarters at Cincinnati, and R. F. Terrill has been transferred from general engineering department at Cleveland to the eastern service division with headquarters at New York.

Columbus McKinnon Chain Co. announces that its executive office will be removed from Columbus, Ohio, to the plant at Tonawanda, N. Y., on or about July 15.

Thew Shovel Co., Lorain, Ohio, report a sales increase for the first four months of 1927 of 60% over the first four months of 1926 and 100% over any previous four months in the entire 32 years the company has been in business.

Chicago Pneumatic Tool Co., New York, N. Y., announces the removal of its St. Louis office, service department and warehouse on July 1, 1927, from 813 Hempstead St. to 1931 Washington Ave., St. Louis, Mo.

Foote Bros. Gear and Machine Co., Chicago, Ill., announce the following new distributors and representatives: Circle Corp., Tulsa, Okla.; Houston Armature Works, Houston, Texas; Briggs-Shaffner Co., Winston-Salem, N. C.; G. W. Craighead, 4-230 General Motors Bldg., Detroit.

Fairbanks-Morse Co., Chicago, Ill., has recently sold Diesel engines to the following rock products plants: Mogadore Sand and Gravel Co., Mogadore, Ohio—360-hp. style "VA" direct connected to F.M. alternator for operating its sand and gravel plant; Kanawha Sand Co., Parkersburg, W. Va.—80-hp. marine engine for tow boat; River Sand Co., Steubenville, Ohio—80-hp. marine engine to operate sand digger; Elberton Quarries, Berkeley, Ga.—240-hp. style "VA" engine for direct connection to Sullivan angle compound air compressor; Dixie Sand and Gravel Co., Chattanooga, Tenn.—120-hp., 4-cylinder marine engine for tow boat; Columbus Gravel Co., Columbus, Miss.—360-hp. style "VA" engine for operating sand and gravel plant.

Farrell-Cheek Steel Foundry Co., Sandusky, Ohio, is building a second large addition to its main foundry building. Increased demand for the company's special steel is said to have made the expansion necessary.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Lorain 75. Broadside featuring uses of the Lorain 75 as a clamshell crane and dragline. THEW SHOVEL CO., Lorain, Ohio.

Hoisting Handbook. Manual containing information about hoists and hoisting work. Specifications and operating data for dragline hoists, etc., Glossary capacity tables, etc. NOVO ENGINE CO., Lansing, Mich.

Pulverizing and Handling Powdered Materials. Bulletin illustrating some recent developments in Raymond pulverizing and air-separating equipment. RAYMOND BROS. IMPACT PULVERIZER CO., Chicago, Ill.

Electric Sander. Bulletin No. 104 on safety electric sanders for mine locomotives, etc. CRAWFORD MACHINERY CO., Pittsburgh, Penn.

Worm Gears and Drives. Bulletin E on Fawcus worm gear speed reducers equipped with Timken roller bearings. Typical installations, engineering and construction data, illustrations of design. FAWCUS MACHINE CO., Pittsburgh, Penn.

Air Compressors. Bulletin No. 807 on "SV" sleeve valve compressors and compressor equipment. Data on design, construction, capacities, etc. NATIONAL BRAKE AND ELECTRIC CO., Milwaukee, Wis.

"Imp" Pulverizer. Bulletin No. 1 on complete unit for pulverizing and separating various materials, particularly for preparations of pulverized coal for boilers and industrial furnaces. Performance data, illustrations of design, etc. RAYMOND BROS. IMPACT PULVERIZER CO., Chicago, Ill.

Pulverized Coal in Industry. Bulletin No. 12 on the application of powdered coal to steam boilers, cement kilns, dryers, etc. Results obtained with air swept tube mill and carbureted fuel. Contains useful tables, charts and quick reference information for power plant engineers. KENNEDY-VAN SAUN MFG. CO., New York.

Long Pipe Lines with Oxwelded Joints. An illustrated record of accomplishments in the oil and gas industries. LINDE AIR PRODUCTS CO., New York, N. Y.

Unit Heater. Bulletin on the Venturafin No. 2 unit heater for heating installation in factories and rooms where larger units are not suitable. Illustrated. AMERICAN BLOWER CO., Detroit, Mich.

Comal Power Plant. Bulletins describing and illustrating the New Braunfels, Texas, station of the Comal Power Co., the first of three plants to burn powdered lignite successfully. COMBUSTION ENGINEERING CORP., New York

General Electric Bulletins. GEA-743 on drum controllers for two- and three-phase slip-ring induction motors; **GEA-780** on solenoid-operated air circuit brakes.

Pierce Governors. Bulletins illustrating applications of Pierce governors for automatic speed control in various types of automotive vehicles, engines, etc. PIERCE GOVERNOR CO., Anderson, Ind.

Worthington Meter Shop. Bulletin No. W-821 picturing the meter manufacturing operations and equipment at the Harrison, N. J., plant of the Worthington Pump and Machinery Corp., New York.

Crawler Shovels. Bulletin **B-10** giving specifications, dimensions and data on design and construction of the complete line of crawler shovels manufactured by LINK-BELT CO., Chicago, Ill.

Westinghouse Bulletins—S.P1774 on different types of trolley, storage battery and combination locomotives for mine and industrial plants; **L.20319** on selection of electrical equipment for lorry cars.

Dorr Washer. Bulletin No. **4071** describing and illustrating the Dorr washer for possible applications in the rock products field. THE DORR CO., New York, N. Y.

Mine and Quarry. June number of house organ published by the SULLIVAN MACHINERY CO., Chicago.